AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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A New Safety Steam Boiler.

The engraving on this page gives a sectional view of the C. M. Miller Economy Steam Boiler.

The idea of the inventor in bringing out this boiler is said to be to obtain all the good points, as near as possible, of the different kinds of steam boilers, and leave out the objectionable features. This apparatus consists of a combination of a vertical boiler for the steam, and the reservoir for water, with a horizontal part with tubes or flues which are entirely covered by water at all times. It also has a jacket with 3 inches space intervening between the boiler and the jacket on the horizontal part, and 2½ inches space on the vertical part.

S D is the smoke dome, *F S* is the fire space between the boiler and Jacket, *F* are the tubes or flues, *S S* shows the steam space, and *W S* the water space, with safety plug which is marked *S P*. *F B* is the fire box, with conical head for crown sheet, which is securely fastened to the upper head, which is also conical, with stay bolts. *F D* is the fire door, *G B* the grate bars, and *A P* the ash box or pit.

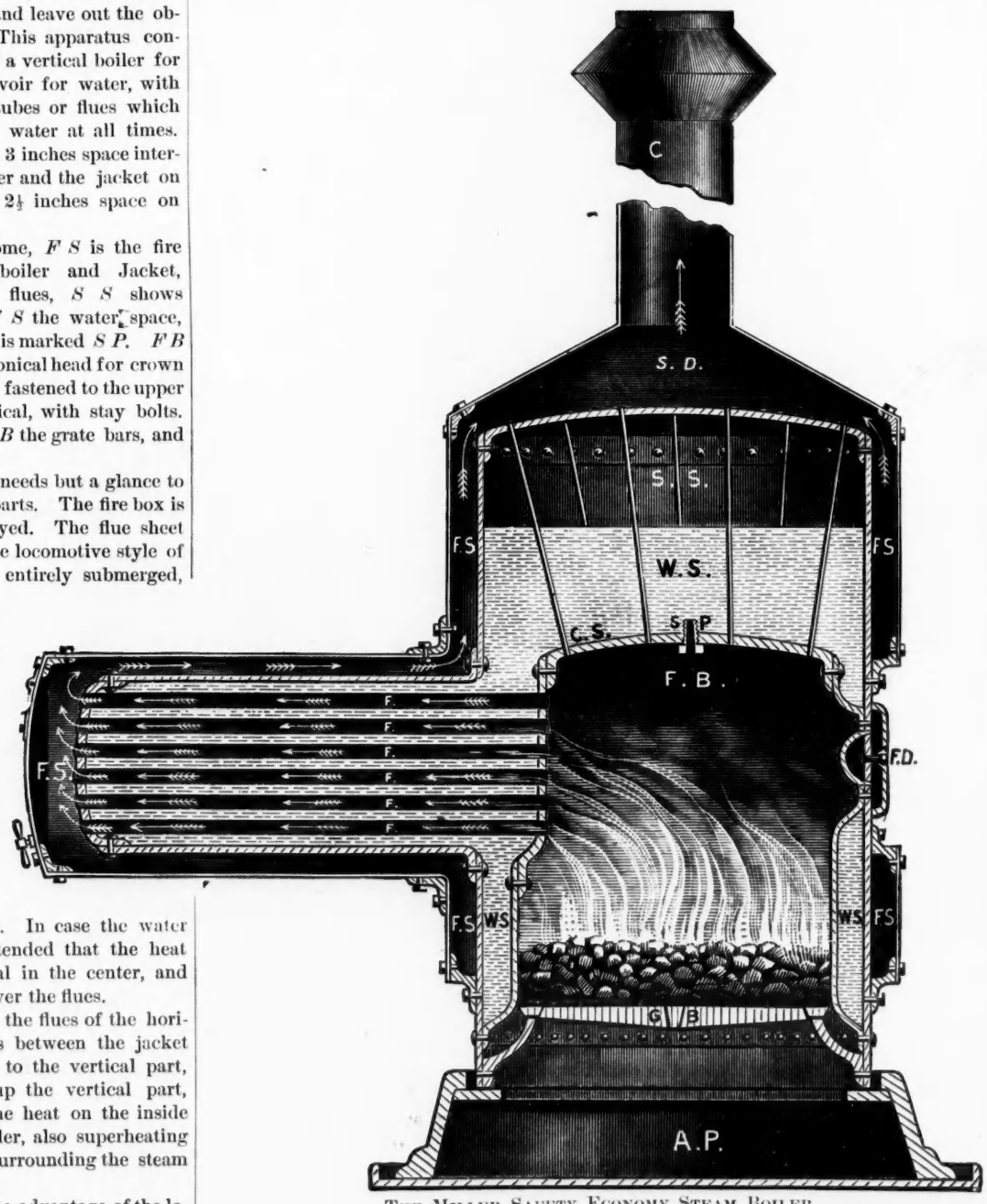
With the lettering, it needs but a glance to trace out the different parts. The fire box is round and securely stayed. The flue sheet is flat, the same as in the locomotive style of boiler. The flues are entirely submerged, the same as in the locomotive style. The main part is vertical, and has a very high range for water, with a large space for steam, as the steam space is not cut up with tubes, as is the case with the plain, upright boiler; it leaves more room, and is not liable to foam.

The safety plug projects above the crown sheet about 1½ inches. In case the water should get low it is intended that the heat will melt out the metal in the center, and leave sufficient water over the flues.

The fire goes through the flues of the horizontal part, and returns between the jacket and shell of the boiler to the vertical part, and the same course up the vertical part, thereby utilizing all the heat on the inside and outside of the boiler, also superheating the steam by the heat surrounding the steam space proper.

The builders claim the advantage of the locomotive boiler by having submerged flues, also the advantage of a vertical boiler by the upright part for large reservoir, without the objection of having flues through the steam; also the advantage of a bricked-in boiler, by returning the heat and by using the jacket for protection against the cold.

The Safety-Economy Boiler Company, of Canton, O., make these boilers, of capacities from 6 to 50 horse.



THE MILLER SAFETY ECONOMY STEAM BOILER.

Ordinary steam pipes used for heating purposes in a room, having and maintaining a temperature of 60°, will, with an uninterrupted circulation, condense .357 lbs. of water per hour for each square foot of surface of pipe, while a coil, under like circumstances, will condense .29 lbs. of water per hour per square foot of surface.

Screw Cutting on the Engine Lathe.

No. 1.

BY FRANK H. RICHARDS

We must not forget the wants of the rising generation of machinists. I have been looking into mechanical journals for more years than I have the courage to count, and in nearly every number I have met some question relating to screw cutting. The making of small screws, which require to be numerously duplicated, is now mostly done by special machinery and in factories for the purpose, so that they can scarcely be said to be the product of the engine lathe. Yet the workman is still required to produce on the lathe screws of every size and shape; he still has to learn all that can be known on the subject, and all such knowledge is as valuable now as ever.

If I seem to take unnecessary pains to be explicit, noting trivial or self-evident points which every workman is supposed to know —but which my observation tells me they do not—I am remembering the needs of the individual of the lowest attainments and the fewest opportunities, assured that if all is made clear to him the more favored ones will readily understand. I offer, then, nothing new—nothing but what is familiar, or should be familiar to the experienced mechanic. I cannot but think that in collecting the points involved in screw cutting I am doing a service to the AMERICAN MACHINIST, and so far as the work is well done I shall have produced something of permanent value.

By slow and laborious steps proficiency is attained in mechanical art as elsewhere. There is here, as in all departments of human occupation, "room higher up," and I shall be glad to feel that I have supplied even one of the lower rounds of the ladder by which any one may mount.

I assume, of course, and mention here, not again to allude to it, that the lathe to be operated is of modern construction, that it is in reasonably good condition, and that the work to be done upon it is not extravagantly disproportioned in size. It is also necessary to assume, as essential to the best success, that the workman is intelligent, careful, ambitious and mechanically conscientious

To begin at the beginning: The pitch of a screw, like the pitch of a gear, is the distance from the center, or side, or any part of one tooth or thread to a similar part of the next thread; or the distance traversed in the direction of the axis of the screw during one complete revolution. In measuring the pitch of a screw we are not limited to a pitch line, as on a gear; but may measure any accessible points of the screw in a direction parallel with the axis.

It is customary in the shop, probably more for convenience in computing the gears for cutting screws than for any other reason, to state the pitch by the number of threads to the inch. Thus: if the pitch is ⅛″ the number of threads to the inch is $2\frac{2}{8}$.

To measure the number of threads to the inch on any screw.—Apply a rule to the side of it and parallel with it. Bring the end of the rule, or any inch mark upon it to coincide with the point of any thread. Then count along the screw the number of spaces which intervene, until the point coinciding with the next inch mark is reached, and the number will be the number of threads to the inch of that screw. Measuring thus, the point of one thread of the screw coincides with an inch mark on the rule. If the point of a thread does not coincide with the next inch mark, then the number of threads to the inch will not be represented by a whole number. In the nomenclature of the shop it will be a fractional thread. In that case we look along the rule two or more inches until we find, if we have length enough, where a thread and an inch mark come together; then counting the threads and dividing the number of threads included between the coinciding inch marks by the number of inches, we have the number of threads to the inch. Thus, if we have 17 threads in three inches, then $17 \div 3 = 5\frac{2}{3}$. Sometimes, if we have not length enough for this, a certain number of threads may be found to measure a fraction of an inch, and we get our result in the same way:—divide the number of threads by that fraction. If 3 threads measure $\frac{7}{8}$″, then $3 \div \frac{7}{8} = 3\frac{3}{7}$.

In measuring a square thread or a thread of any other shape, the point to be observed is to count from similar points of the threads every time. If the thread to be counted be double, triple or multifold (which may be discovered by the number of threads at the end of the screw or nuts, or by following one thread around the screw, and noting whether it adjoins the one from which the start was made or how many intervene) then the pitch of the screw will be found by counting only every second or third or every other thread, as the case may be. To count the number of threads in a nut or a tapped hole, the best way usually is to screw a wooden plug into the hole, and upon removing it to count the marks upon it.

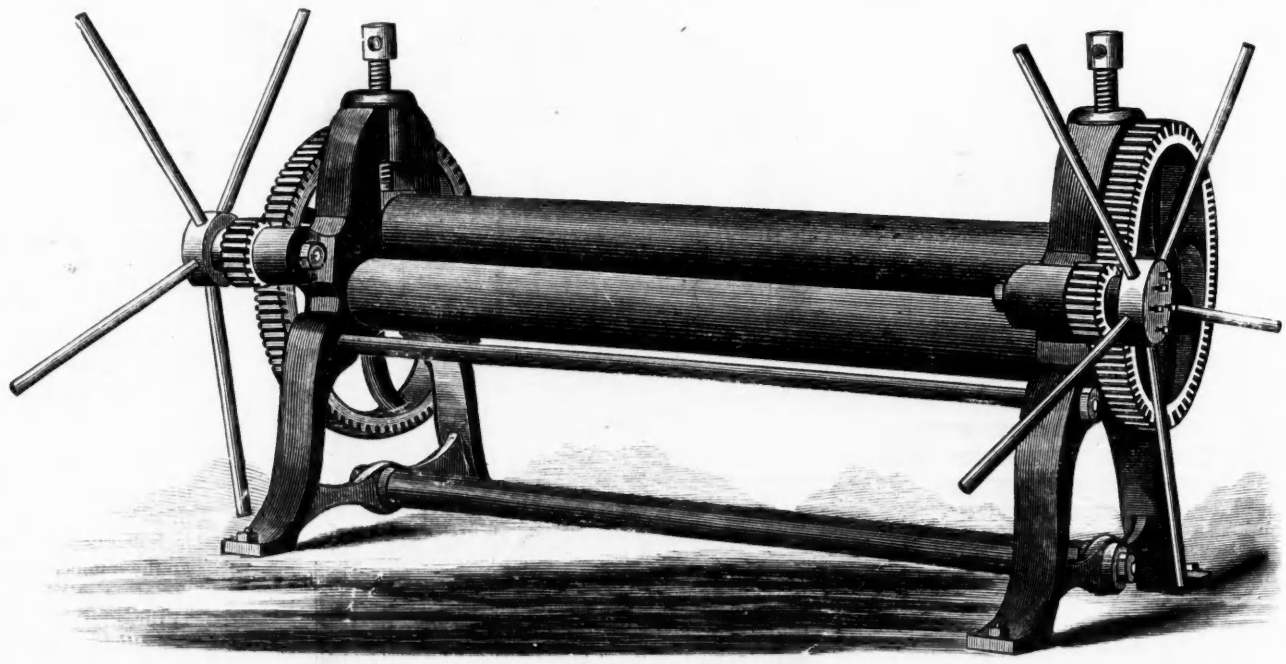
Every one who runs a lathe should be able to compute the gears for cutting threads. The published tables, from the fact that the lathes of different makers and the different sizes from the same maker use different gears, are of little practical value. Far better than any formal rule is a clear understanding of the simple principles involved,

enabling the workman to make his own rules and to compute his own tables.

We will begin with the simplest case that occurs. Most lathes carry a small spindle geared to the main spindle, and running at the same speed, to carry the driving gear for cutting threads. Let us place upon this spindle any gear we choose, say 40. We place upon the leading screw another gear with the same number of teeth—40. We connect these by an intermediate gear of sufficient size, remarking that the number of teeth upon the intermediate or connecting gear makes no difference, as it transmits tooth for tooth, just the motion that it receives. Upon starting the lathe and locking the nut, the tool traces upon the piece in the lathe a thread of the same pitch as the leading screw. We now, retaining the same gear, 40, on the spindle, change the gear upon the screw to 80, and connect by the intermediate as before. In this case it takes two revolutions of the lathe spindle to make one of the screw. The screw goes one half as fast as the spindle. The tool cuts a thread one half the pitch of the leading screw or double the number of threads to the inch. The gear upon the screw is double that upon the spindle, and the thread cut is double that of the leading screw. It is a case of simple proportion. The thread cut is to that of the leading screw as the gear upon the screw is to that upon the spindle, or, inverting the order, the gear upon the spindle is to the gear upon the screw as the thread of the leading screw is to the thread which the lathe will cut under the circumstances.

Boiler Bending Rolls.

One of the important tools in a boiler shop is a set of bending rolls. Such a tool should have strength, be easily operated, and have quick adjustment for different radii. Much time is lost by the use of clumsy, ill-designed rolls. In fact, notwithstanding radical improvements in nearly all other tools pertaining to boiler making, the ordinary rolls in use in the majority of shops seem to be made on the plan of anything is good enough. Our engraving on this page represents a set of bending rolls, as manufactured by the Whitcomb Manufacturing Co., of Worcester, Mass., which seem to be constructed for utility, and at the same time to present a respectable appearance. As will be seen, it is the usual set of three rolls, two of which are geared. They are made to roll plates up to six feet in width. The manner of driving with pinion and wheel does away with the immoderately long levers used where the lever is on the end of a roll, and makes the tool more compact and serviceable.



Boiler Bending Rolls.

We learn from the *Popular Science Monthly* that M. Soleillet, a French engineer, has recently communicated to a society of engineers some very interesting intelligence embraced in the observation of his fourth journey across the Sahara. This journey was undertaken for the purpose of finding the products of the soil, especially in their probable commercial relation to the proposed railroad across what was at one time thought to be an unexplored desert. He found among other things coal and saltpeter; also the famous butter tree, known since the days of Mungo Park. The vegetable butter from this tree furnishes a stearine which can be satisfactorily used for illuminating purposes, oiling machinery, tempering steel, etc. He also discovered a plant, the *fernan*, which produces a substitute for pitch in calking boats, and from

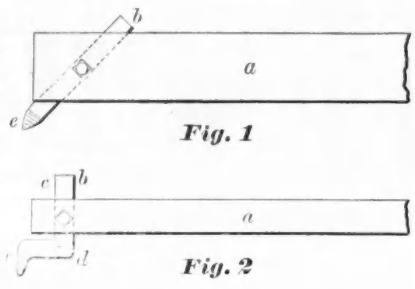


Fig. 1

Fig. 2

which a substance much resembling india-rubber has been extracted. The climate is said to be healthy, and much of the soil productive.

A Worcester, Mass., manufacturing company advertises "Wire Drawers!" This article of apparel will undoubtedly be well appreciated for the summer season, as full ventilation will be assured. As to wearing qualities there can be no doubt. Laundry bills may thereby be reduced, as no starch will be needed for the new garment. Since wire hoopskirts went out of fashion, manufacturers have striven to find some new place for the wire thus ruthlessly discarded. Here is the solution of the problem.

Shop Kinks.

No. 11.

Boring Tools.

By L. F. Lyne.

In boring large castings, such as cylinders, hubs of wheels or other work which is generally attached to the face plate of a lathe, too light tools are used, as a rule. I remember once having a lot of wrought iron cylinders to bore. They were 34″ in diameter inside, 17½″ long, and were to be turned, inside and outside, to a thickness of $\frac{5}{16}$.″ The proprietor insisted that they could be caught in a chuck, and, after facing off one edge, they could be bolted against the face plate by using hooked bolts. The experiment was tried with one cylinder, and the time occupied was a little over twenty-four hours. When the bolts were loosened, the cylinder moved in all directions, having been sprung by tightening the hooked bolts.

I then made a proposition which was accepted. It was to get a cast iron cylinder made, of a sufficient diameter to freely admit the wrought iron cylinders. The cast cylinder was to be made by sweeping up the mould without a pattern, leaving a flange upon one edge for bolting it to the face plate.

Twelve set screws were to be inserted through the sides of the cylinder, so that when the wrought iron cylinder was placed inside, by first tightening all the set screws with the fingers, then giving each of them about a quarter turn with a small wrench, the cylinder would be held securely without springing.

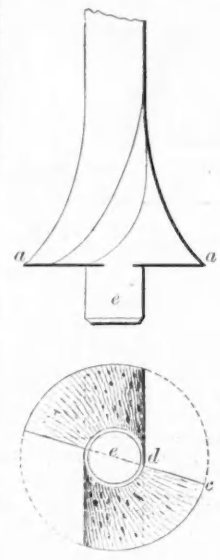


Fig. 3

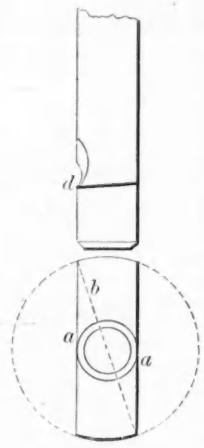


Fig. 4

The first cylinder bored was with a tool inserted in the end of an iron bar 1½″x2½″, as shown at *a* in Fig. 2 of the accompanying engravings. The hole for the tool *b* being about 1″ from the end of the bar and cut square across, required an offset in the tool in order to allow the cutting edge *e* to project beyond the end of bar. The result was that a good cut could not be carried, as the offset in the tool caused it to spring, and unless great care was exercised it would be twisted off, as shown at *d*. Several tools were broken in this way.

After the new cast iron cylinder was made I got a bar of steel 3″ square by 30″ long, and cut a hole $\frac{13}{16}$″ square to admit tools made of ¾″ square steel, as shown in Fig. 1. It will be observed that by this procedure a straight tool can be used, and the cutting edge *e* of the tool *b* will project beyond the end of the bar. This bar may be used left handed simply by turning it upside down. The angularity of the hole for the reception of the tool gives a better support to the cutting edge than when it is cut square across.

The result of the change described was that only five hours were occupied in boring each of the wrought iron cylinders, and the work was done in a very satisfactory manner. The outside of the cylinders were finished by placing them upon a heavy pulley driven upon a mandrel 4″ in diameter. The pulley had a dozen set screws through the rim, which were tightened as described for boring the cylinders. I believe that all boring bars to be used in the tool post for general lathe work should have the tool slot cut as shown in Fig. 1, and the only argument I ever heard in favor of the plan shown in Fig. 2 was that it had always been done.

For boring flue sheets for boilers many elaborate tools have been designed and used, some of them performing their work in a very creditable manner, while others have been a constant source of annoyance from breaking of the tools, expense of renewing the same and keeping them in order.

A very simple tool is shown in Fig. 3, which has been used to a limited extent in locomotive works and railroad repair shops It is simply a counter-boring tool with the outer end of each cutting edge set ahead so as to cut more freely. The common counter-boring tool is usually made as shown in Fig. 4, where it will be noticed that the angles of the cutting edges at *a a*, with the center of the tit are such that it is impossible for them to cut, so they merely tear their way into the material to be cut, and require an excess of power to force the tool to do its work. As the cutting edges wear away this evil increases, as shown at *d*, where it may be seen that the outer edge is gradually brought to the rear instead of being in advance as it ought to be. The proper angles for the cutting edges are shown by the dotted line.

It will be seen that this idea has been carried out in Fig. 1, where the cutting edges occupy a radial position with the center, consequently all parts must cut with equal freedom, the part at *d* cutting as freely as at the outer edge *e*.

The lips *a a*, can be easily thrown in advance by a good tool maker, and are readily kept in order. The end of the tit *e* should have teeth cut in it so as to prevent it from being twisted off by being forced into a hole too small to admit it. For boring holes up to 2¼″ in diameter this tool has superior advantages. I have bored a hole with one of these tools 2$\frac{1}{16}$″ in diameter, through a flue sheet $\frac{7}{16}$″ thick, in three minutes, frequently taking out shavings six and eight feet long.

When these tools are made of the best tool steel they never fail to give satisfaction.

A Chicago man advertises a new "boiler purger," which he has discovered. He fails to say in his announcement whether this medicine is administered with a spoon or in sugar coated pellets. Now let somebody discover a "boiler cathartic."

The following notice, promulgated by a Virginia blacksmith, shows business tact:

"Notis. — De co-partnership heretofore resisting betwixt me and Mose Skinner is hereby resolved. Dem what owe de firm will settle with me, and dem what de firm owes will settle with Mose."

Publications of the U. S. Patent Office.

We make the following extracts from the price list of publications of the United States Patent Office, to answer numerous inquiries we have received. The *Official Gazette* is a weekly publication, giving drawings and claims of every patent issued, also decisions, record of trade marks, designs, &c.

Subscriptions to Official Gazette:	
To all subscribers within the United States, one year, January to December	$5 00
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Single copies, if printed	25
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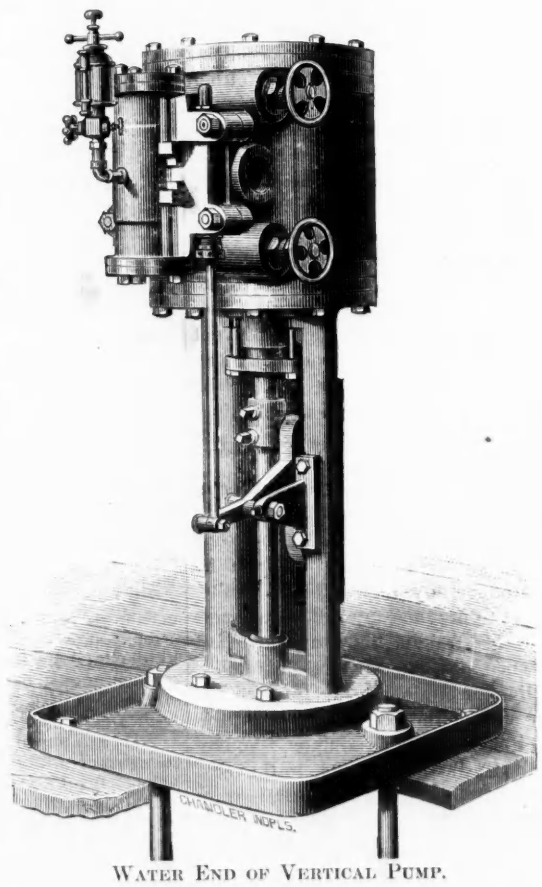
For the convenience of those who do not desire to order as many as twenty copies at one time, coupon orders, good for one drawing and printed specification, are sold in quantities of twenty or more, at ten cents each. These may be used singly, and are good till used.

All communications must be addressed "Commissioner of Patents, Washington, D. C.

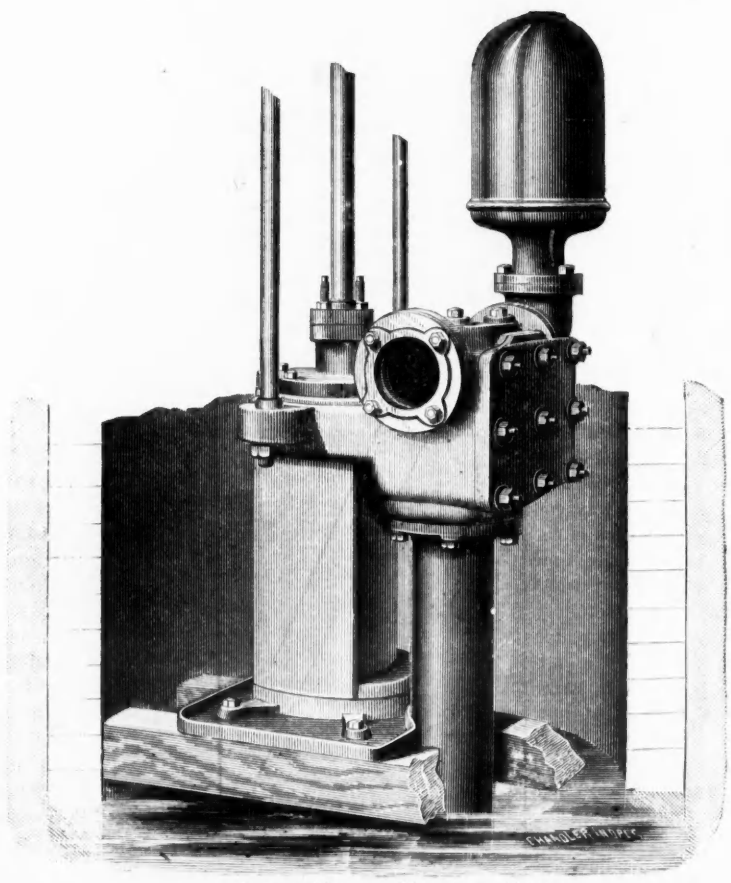
The Boston *Herald* thinks that "the man or company who can place a good serviceable type-writing machine on the market for $25 will have something better than an average paying "gold mine."

New Vertical Steam Pump.

The vertical steam pump shown in the accompanying engravings is designed for pumping from deep wells, mine shafts, deep cellars, or for places where it is inconvenient or impossible to use horizontal pumps. The steam cylinder and supporting frame are placed over the mouth of the well, or shaft, so that it is always accessible to the engineer, avoiding the necessity for the engineer to go below to start the pump. The steam valve gear is substantially the same as that of the pump, which was illustrated in American Machinist July 2nd, except that the amount of steam for the up or down stroke is controlled by separate throttles, shown in the engraving herewith, by which a uniform piston speed is produced for any depth or head, which must be pumped against. It is evident that less steam should be admitted for the down stroke, as the weight of the pistons and long rod assist it in forcing the water as they descend.



Water End of Vertical Pump.



Steam End of Vertical Pump.

The main steam piston is properly cushioned, so that the action of the pump is quiet, even when working rapidly.

It has no "dead point," always starting at any point of the stroke when steam is admitted. The water cylinder is fastened to the cross timbers near the water, and is joined by two stay rods to the base of the steam cylinder frame. To stiffen stay rods and prevent the springing of piston rod, iron clamps are bolted across the stay rods, through which the piston rod moves. The pump shown in cut is double acting, and, therefore, will deliver a continuous stream of water.

For depth exceeding 150 feet a single acting plunger pump is used, which delivers only on the downward stroke. It will be seen that the valve chamber is placed high on the water cylinder, so that the discharge valves are above the level of the pump cylinder, thus avoiding all "air pockets," and insuring the filling of pump cylinder at each stroke. The valves can be quickly examined or removed by taking off the side plate. These pumps are made in various sizes and styles. The relative areas of the steam and pump piston depend on the height water has to be forced, and other varying conditions. They are manufactured by Dean Bros. Steam Pump Works, Indianapolis, Ind.

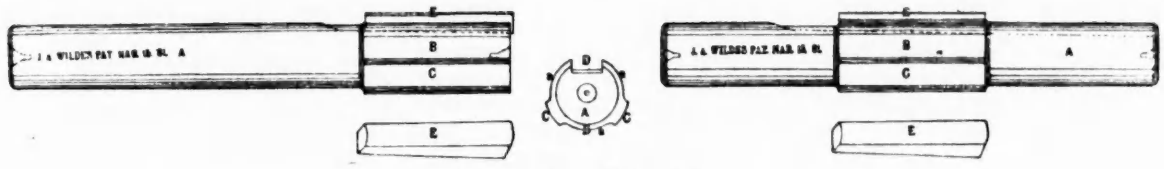
An Improved Mandrel.

The difficulty of keeping mandrels true and accurate is well known to the lathe hand.

The intelligent workman, knowing that cause precedes effect, looks for a reason, and finds that the process of driving mandrels into bored or reamed holes causes them to become appreciably smaller, while the hole in the piece, which ought to be a standard size, is appreciably expanded. This proceeding not only produces bad work and varying sizes in the reamed hole, but entails extra expense by rendering the mandrel useless, and compelling the workman to provide a new one when occasion requires its use.

To obviate this difficulty, an improved mandrel has been invented by J. A. Wilde, of Hudson, N. Y., and which we herewith illustrate. The object of the invention, as stated by the inventor, is (1.) to provide a mandrel that may be readily inserted in and withdrawn from the bore of the piece of work to be turned; (2.) That shall furnish a parallel bearing the full length of the bore, or any part thereof, and thereby be secure against turning; and (3.) That will remain "true" through long-continued use.

The improvement consists in a mandrel having an enlargement or boss, *B*, in the middle of its length, or at either end, a part of which boss is cut away, so as to form two raised parallel longitudinal bearings *C*, and a corresponding groove, *D*, which are at equal distances apart, the said groove being deeper at one end than at the other, and being designed to receive the third bearing, which consists of a corresponding key, *E*, to be forced into the groove, thus securing the mandrel firmly in place in any piece of work.



An Improved Mandrel.

It is claimed for this mandrel that it is simple in construction, requiring no special tools to manufacture; also that when properly constructed it is accurate and will maintain its accuracy for a much longer time than the ordinary mandrel, which has to be driven into the hole with a sledge, from the fact that the only part subject to frictional wear in inserting in, or removing from, the hole, is the key *E*, which wear does not in the least impair the accuracy of the mandrel.

We are told this mandrel has been in constant use in a large manufacturing concern for two years, in which time it has fully demonstrated its utility.

Hints on Making Ready for Cylinder Presses.

We make the following extracts from a well-prepared article upon the above subject in R. Hoe & Co.'s new illustrated catalogue of printing presses and printers' materials:

1. The nature of the making ready should be governed by the paper provided for the work. Soft newspaper readily takes impression; hard writing paper resists it. When little time can be allowed for making ready, the paper should be wet down and made pliable the day before the form goes to the press; and the quires of damp paper should be turned, and put under heavy weights, or in standing press, so as to make the sheets equally damp in every part. Avoid overdamping. Job and wood-cut work are most acceptably done on dry paper, but usually at greater loss of time in making ready.

2. See that the bearers of the bed are properly adjusted, a trifle more than type height, and that both impression screws have proper bearings on the journals, so as to allow the cylinder to fairly, but not too firmly, press upon the bearers.

3. The packing, or the impression surface of the cylinder should next receive attention. Every press is provided with an India-rubber blanket, which makes the most serviceable packing for general work. It is smooth, firm, elastic, and will last a long time, if carefully treated. Do not allow oil or grease to get on it. Do not paste overlays on it.

4. For rude press work, like posters, old plates, or newspapers set in worn type, the India-rubber blanket is, by some printers, thought not sufficiently elastic. They prefer a woolen blanket, because it helps them to make ready quicker. But what may be gained in speed by use of blanket is lost in increased wear of type and inferiority of impression. The more elastic the surface, the duller or coarser the print.

5. Fine press work is most surely had by the aid of an inelastic press-board packing. This press board is the hard and strong board which is usually provided for the dry pressing of printed sheets in standing presses. Press-board packing can be used to advantage only on forms of type, or on plates made from types, that are as good as new. As it compels the pressman to slow and careful making ready, it cannot be used to advantage on general job work, or on small editions. When a form of new type has been properly made ready for this packing, it will show a sharper impression than can be made by any elastic packing. Properly used, it is not wearing to type.

6. The different kinds of packing may be combined for special kinds of work. Flannel or billiard table cloth may be put over a thin press board packing; two or more sheets of paper may be put over a rubber blanket.

7. The packing selected should be tightly stretched over the cylinder, without bag or wrinkle. Labor in making ready is thrown away if the packing be not kept tight. One end of the rubber or woolen blanket may be fastened on the hooks that project inward in the opening at the gripper edge of the cylinder. The other end may be tightly laced with saddler's thread at the other opening. A better way is to sew a strip of canvas on that end of the blanket and to wind it around the wheel in this opening.

8. To put on a press-board packing, select a board the full width of the cylinder between the bearers, and about ten inches longer than the impression surface. If the board be too wide between bearers, cut down to exact length. Cut with sharp knife, straight and smooth, leaving no rough or turned edge. Carefully crease the part of the board that will be under the grippers, about one half-inch from the edge. Lay this creased part on the flat edge of the cylinder at its opening, cover it with a thin cherry reglet, and bring down the clamps provided for the purpose quick and hard, so as to hold the board securely against any pulling from the other end. Proceed in a similar manner at the other end, stretching it so tightly that it hugs the cylinder at every point. Some pressmen carefully dampen the packing after it has been put on, by repeated spongings, until the board swells and bags. When it has swelled sufficiently, they restretch the board and fasten it down. As the board slowly dries it contracts and hugs the cylinder with great tightness. To restore the surface, made somewhat rough by dampening and stretching, it must be covered, when dry enough, with shellac varnish. This is tedious work, usually taking two, sometimes three days; but it is worth the trouble, for a packing neatly put on will last, with care, for years.

Mechanical Drawing.

BY PROF. JOHN E. SWEET.

INSTRUCTIONS FOR PRACTICE.

In the first lesson it was the aim to impress the student with the importance of working with as much accuracy as possible; for upon the accuracy of the work depends the accuracy of the results.

In the kind of work suggested for this lesson an entirely different principle must govern every move. Rightness is altogether a different thing from accuracy. To illustrate: A shaft, 1 inch in diameter, is required or may be already in a machine. The draughtsman makes his drawing $\frac{1}{32}$ inch too large or too small, but figures it one inch. The drawing is all right, because it represents the thing as it is, or, if made to the figures, will be what is required; still it is not accurate. On the other hand, a bolt, 8 inches long, may be required. The draughtsman draws it 7 inches to a decimal. It will be very accurate, but an inch too short. The important thought I wish to enforce by this is, the necessity of thinking what you are about:

1st. Do not expect to arrive at anything like correct results in solving problems by the graphic method, except by careful work.

2nd. Do not fool away a lot of time in measuring the sizes of waste oil cups, and drawing them to the $\frac{1}{64}$ of an inch, when the size to the eighth or quarter is near enough.

The man who works with accuracy, where accuracy is required, and with indifference, when the requirements are indifferent, is sure to be thinking of what he is about. He is not likely to make such outrageous blunders as the man who knows nothing but fine measurement, nor is he half as long about it.

In the advice given last week for the selection of some object to represent "something that the student has at hand" may not have been quite sufficiently explicit, for he might have a locomotive in sight and a cold chisel in his hand. Try the cold chisel first; or, better still, make a drawing at a scale of $\frac{1}{2}$, $\frac{1}{4}$ or $\frac{1}{8}$ the size of the drawing board you are working upon. Measure the board carefully, and as there are but these general dimensions it is well to make them all and carry their dimensions in your mind, simply as discipline in that kind of memory. Do not go through the mental operation of dividing, but if you are working at, say $\frac{1}{8}$ full size lay your scale upon the paper and run off as many eights as there are inches in the measurement. That is, supposing the board to be $26\frac{1}{2}$ in. long, with a base and vertical line to represent the bottom and left hand end of the board, then with the zero of the scale to the vertical line, run along with the pencil, counting 8, 16, 24 as you come to the full inches; 25, $26\frac{1}{2}$ as you reach the $3\frac{5}{16}$ inches. In this way you soon get to feeling the $\frac{1}{8}$ of an inch is the expression of an inch, and for the time cease to consider it as an 8th. After drawing the four lines representing the boundary of the board, determine the radius to which the corners are rounded, if rounded at all; and if you have the small bow pencil, strike them to the proper curve with it; if not, round them by free-hand. It is not an easy matter to set the compass so a circle will blend properly with two straight lines. The following method will be found an assistance: Set the pencil point of the bow pencil at the corner, and the needle-point on one of the lines, as at A, Fig. 14; then strike an arc, as shown at *B*; then place the pencil point at *C* and the needle point on the arc.

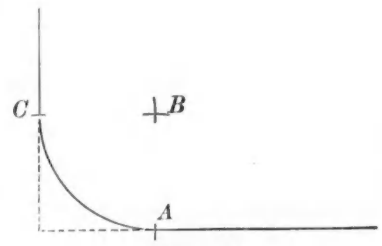


Fig. 14.

A circle struck from this center will blend with both lines. When the drawing is to be inked, and the draughtsman is not specially expert, two lines drawn, as shown at *A* and *C*, showing where the circle should end, is a help. The circles should be inked in first, and the straight lines drawn to join them. If the original lines are drawn fine, and the ends extending too far be erased, the drawing can be gone over the second time with the pencil, and a fair-looking drawing produced by the pencil alone.

If the board has been slit in strips as heretofore recommended, the lines representing the joints can be drawn, and the spacing done by experimenting with the dividers, or without experimenting with the scale. Let us assume there are twelve strips in the board, and the drawing is $2\frac{3}{4}$ in. wide. If the drawing were 3 in, wide, every $\frac{1}{4}$ of an inch would represent a strip; but being less, the strips are proportionally less. Now if the drawing scale is turned at an angle across the drawing until the 0 and 3 in. mark of the scale coincide with the two edges of the drawing, the points can be laid off from the $\frac{1}{4}$ in. marks, the same as if the drawing were three inches wide. To make the drawing complete, a view of the end or side, or both, of the board must be given.

Fig. 16.

Fig. 17.

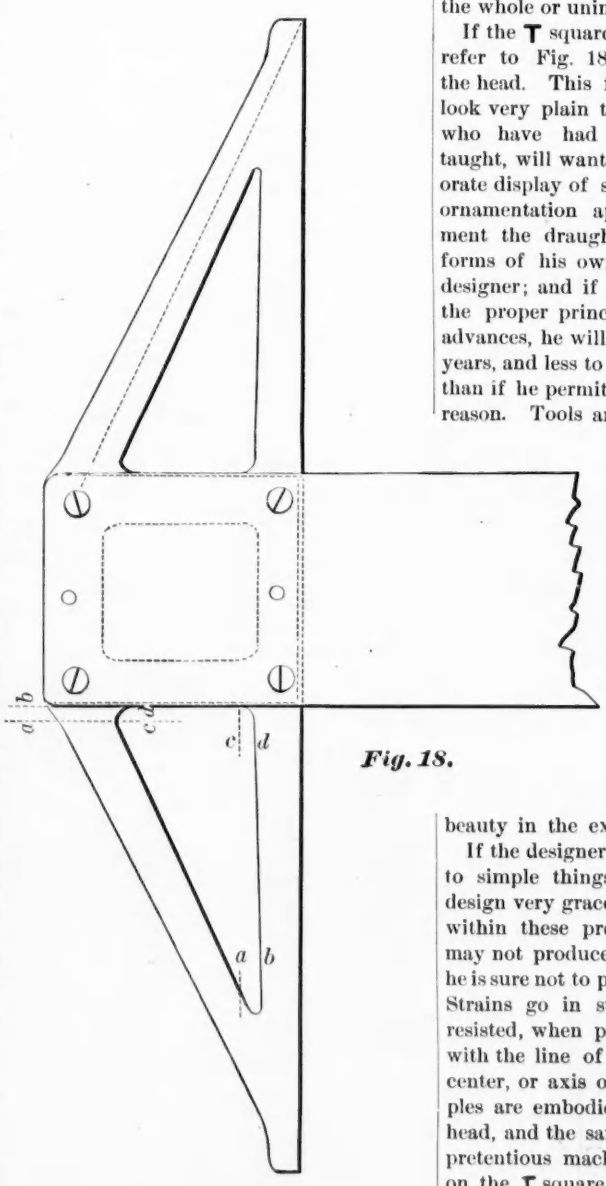


Fig. 18.

After the two lines representing the thickness of the board either above or below, or at either end, the proper length or width can be laid off by simply squaring over from the original drawing. Such a view is called by the mathematician and instructors a projection, or projecting the drawing. But if the drawings were of a machine, it would be by mechanical draughtsmen called a side, front or back view, as the case might be; if of a building, it would be called a front or side elevation. This is the basis of all drawings used to represent objects, and if the drawing as now finished be given to a workman, and the scale to which it is drawn designated, the workman can make another board like the original without further explanation. It is desirable, however, to put upon each drawing the dimensions in figures. It would seem that a simple sketch with the figures would be just as valuable as a complete drawing; and in this case it would be, but as the work becomes more complicated, the advantage of complete drawings becomes more apparent.

The T square may next be taken as a good object to represent, referring to the Figs. 2 and 6 for the methods of representation, rather than things to copy. This class of drawing, that is, the making of drawings of things already made, requires absolute fidelity in the representation. In this class of work it is better to illustrate a dozen unimportant features than omit one important one. The omission of a single line sometimes leaves an important part unintelligible. If the square is a wooden one, the kind of screws, even with which the blade is fastened, should be indicated. The ordinary method of representing the common wood screw is shown in Fig. 16, and a complete representation by Fig 17. In making such drawings as this of the T square, it is not unusual to break out a piece of the work in appearance, so as to get the important parts on a large scale or full size, and yet not take up the necessary paper to show the whole or unimportant parts.

If the T square is of the steel kind, Fig. 6, refer to Fig. 18 for an enlarged view of the head. This form of head will no doubt look very plain to many. Especially those who have had free-hand, as ordinarily taught, will want to branch off into an elaborate display of scroll work, believing such ornamentation appropriate. But the moment the draughtsman begins to conceive forms of his own then he begins to be a designer; and if he will school himself in the proper principles of designing, as he advances, he will find less to unlearn in after years, and less to look back upon with regret than if he permits fancy to take the place of reason. Tools and machines should not be made ornaments. Neither should they be made ornamental, when making them so interferes in the least with their utility, their use, or with the facility with which they can be cared for, or kept clean. A strict adherence to these principles does not in the least prevent tools from possessing elegant forms, and the construction of machines possessing grace and beauty in the extreme.

If the designer cannot give graceful forms to simple things, he will not be likely to design very graceful ornaments. If he keeps within these prescribed limits, though he may not produce any very brilliant results, he is sure not to produce any ridiculous ones. Strains go in straight lines, and are best resisted, when possible, by straight bodies, with the line of strain passing through the center, or axis of the body. These principles are embodied in this simple T square head, and the same is applicable to the most pretentious machinery. The natural strain on the T square head is at the ends, and must be resisted by the screws. Lines running from the end to the screws, pass as near through the center of the arms as they well can. The accidental strains, which, in this case, are likely to be much greater than the natural ones, are likely to come from dropping the square on the floor. The worst place for it to strike would be on one end, and here the strain would be resisted in the best possible way. The arms are made widest at the center, to resist side strain.

To determine the size of curve, to use at the junction of the brace and body of the head, I have found that the method here shown looks well. Let the altitude of all the curves be equal. That is, the distance from *a* to *b* and from *c* to *d* are the same. Any projecting arm should be the strongest, and finished with a root or curved joining, when it joins the body of the work, as a limb of a tree is tapering and joins the body of a tree with curves at the junction.*

Do not attempt to find out the right and wrong ways to represent an object, for there is no such thing as right and wrong about it. Do not have any set ways or rules (conventional ways) to make your drawings. You will be a great deal happier without them. If your view of the drawing board looks better to you with the lower and left hand end lines made twice as large as the others, make them so, unless there is some greater reason for doing otherwise. Do not try to save two cents' worth of paper by spending two dimes' worth of time and thought and bother getting three or four views, one over the other, on the same paper, in broken parts, dotted lines and the like.

*In the designing of this T-square head no thought was taken of this principle, but the pattern was whittled out until it appeared to satisfy the designer, and it was afterwards found that the axis of the brace was on a line from the corner to the screw, and so it will be found with a great majority of our best-designed machinery, and all architectural styles. They have been made to look right at first, and the laws of right have been discovered afterwards.

Removing Scale in Boilers.

From a publication entitled "Steam," containing useful information for steam users, issued by the Babcock & Wilcox Co. of New York, we extract the following:

It is absolutely essential to the successful use of any boiler, except in pure water, that it be accessible for the removal of scale, for though a rapid circulation of water will delay the deposit, and certain chemicals introduced into the water will lessen it, yet the only certain cure is periodical inspection and mechanical cleaning. This may, however, be rendered less frequently necessary, and the use of very bad water more practicable by the use of some preventives. The following are a fair sample of those in use, with their results:

Waters containing bicarbonate of lime in solution may be caused to deposit a considerable portion of the same by simply heating to 212 , which drives off a portion of carbonic acid, and reduces the bicarbonate to the insoluble carbonate. This principle is the basis of a large number of heaters and "lime catchers," but it has no effect on other impurities.

The addition of milk of lime or of metallic zinc has a similar effect, and they have been used with success in waters charged with bicarbonate of lime, but on sulphate of lime they have no action.

Oak, hemlock, and other barks and woods, sumac, catechu, logwood, etc., are effective in waters containing carbonate of lime or magnesia, by reason of their tannic acid, but are injurious to the iron, and not to be recommended.

Molasses, cane juice, vinegar, fruits, distillery slops, etc., have been used with success so far as scale is concerned, by reason of the acetic acid which they contain; but this is even more injurious to the iron than tannic acid, while the organic matter forms a scale with sulphate of lime when it is present.

All "anti-incrustators" containing organic matter are to be avoided. M. Bidard's observations show that they help rather than hinder incrustations.

Barium cloride and milk of lime are used with good effect at Krupp's Works in Prussia, for waters impregnated with gypsum.

Soda ash and other alkalies are very useful in waters containing sulphate of lime, by converting it into a carbonate, and so forming a soft scale easily cleaned. But when used in excess they cause foaming, particularly where there is oil coming from the engine, with which they form soap. All soapy substances are objectionable for the same reason.

Petroleum has been much used of late years. It acts best in waters in which sulphate of lime predominates. As crude petroleum, however, sometimes helps in forming a very injurious crust, the refined only should be used.

Rogers' tannate of soda is probably the best preparation for general use; but in waters containing much sulphate, it should be supplemented by a portion of carbonate of soda.

For muddy water, particularly if it contain salts of lime, no preventive of incrustation will prevail except filtration, and in almost every instance the use of a filter, either alone or in connection with some means of precipitating the solid matter from solution, will be found very desirable.

In all cases where impure or hard waters are used, frequent "blowing" from the mud drum is necessary to carry off the accumulated matter, which if allowed to remain would form scale.

A Special Boring Bar.

By F. F. Hemenway.

The tool shown in Figs. 1 and 2 was made by the writer some years since to bore a number of wrought iron cylinders for hydraulic lifts, and served its purpose so admirably as to lead to the belief that a knowledge of it may be of service to others. The cylinders were about 9 inches in diameter and 9 feet long, and had been bored with a bar and sliding head; but were altogether so rough and untrue as to render it certain they could not be used as they were. The problem was to ream the holes smooth enough to allow leather packing to work in them satisfactorily under a pressure of 400 or 500 pounds to the square inch. An examination showed that to do this, and at the same time bring them to uniform size, would require an enlargement of the bore of from $\frac{1}{8}''$ to $\frac{3}{16}''$, so that the reaming assumed the proportions of boring.

A 3″ hot rolled steel shaft was obtained, and found to be round and straight enough to serve as a boring bar. To one end of this a cast iron head, Fig. 1, was fitted, and in the head dove-tailed grooves were planed, as shown. Into these grooves pieces of steel were fitted, turned to size and formed as cutters, shown half size at Fig. 2. The reason for planing the grooves at an angle with the axis of the bar was to counteract the tendency of the head to "draw in" with the cut, and to keep the bar back, and against the feeding device. The boring of the cylinders with this bar was accomplished as follows:

One end of each cylinder being threaded to screw into a casting which formed the base of the lift, one of these castings was fastened to the face plate of the lathe, and served to drive all the cylinders while being bored. The other end of the cylinder was run in the back rest in the customary manner. The tail spindle was removed, and a bushing, bored to fit the bar, was put in its place. The cylinder was bored with a tool in the tool post for an inch or so exactly the size of the cutters in the cutter head; the bar passed through the bush in the tail stock, and the head entered into the cylinder. The feeding of the head through the cylinder was accomplished by fastening two uprights to the carriage, and extending two $\frac{3}{8}''$ rods back to a little beyond the end of the boring bar, and connecting them by a cross strap. A double-ended wrench on the boring bar kept it from turning. In order to keep the cutters properly lubricated, a wooden collar, having an outside diameter equal to the finished bore of the cylinder, and a hole through it, so as to pass easily over the bar, was put in place on the bar; and, as soon as the cutter head had entered to a little more than its depth in the process of boring, this collar was driven into the end of the cylinder, a plug removed from the base casting, which was hollow, and the cylinder filled one-quarter full of a compound such as was used for drilling wrought iron, the wooden head previously referred to preventing it from running out. This provided for perfect lubrication.

The boring proceeded with reasonable dispatch, and the finished cylinders were smoother than it seemed possible to bore wrought iron. The hollow base into which the cylinder was screwed served a useful purpose. It formed a receptacle for the chips, which were pushed along in front of the head, and which would have caused trouble had not some such means been provided.

Although this tool was especially designed for boring wrought iron, which presents peculiar difficulties (in the instance of a long hole, which is required to be quite smooth), there is no reason to believe that it would not do equally good work on long cast iron cylinders.

Competition, if not a cure for selfishness, at least leads a man into the way of thinking of his neighbor. We heard it forcibly put by an engineer not long since. Said he: "A few years ago, when a man contemplated starting a machine shop, he was mainly interested in knowing what *he* could do. To-day he looks around to see what his *neighbor* can do."

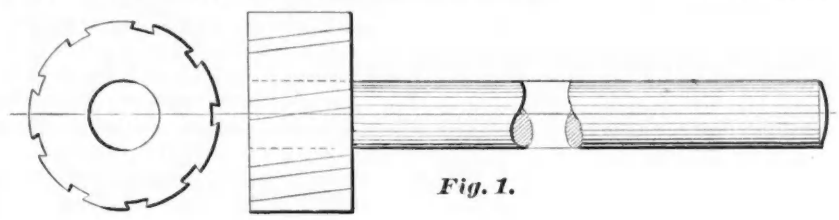


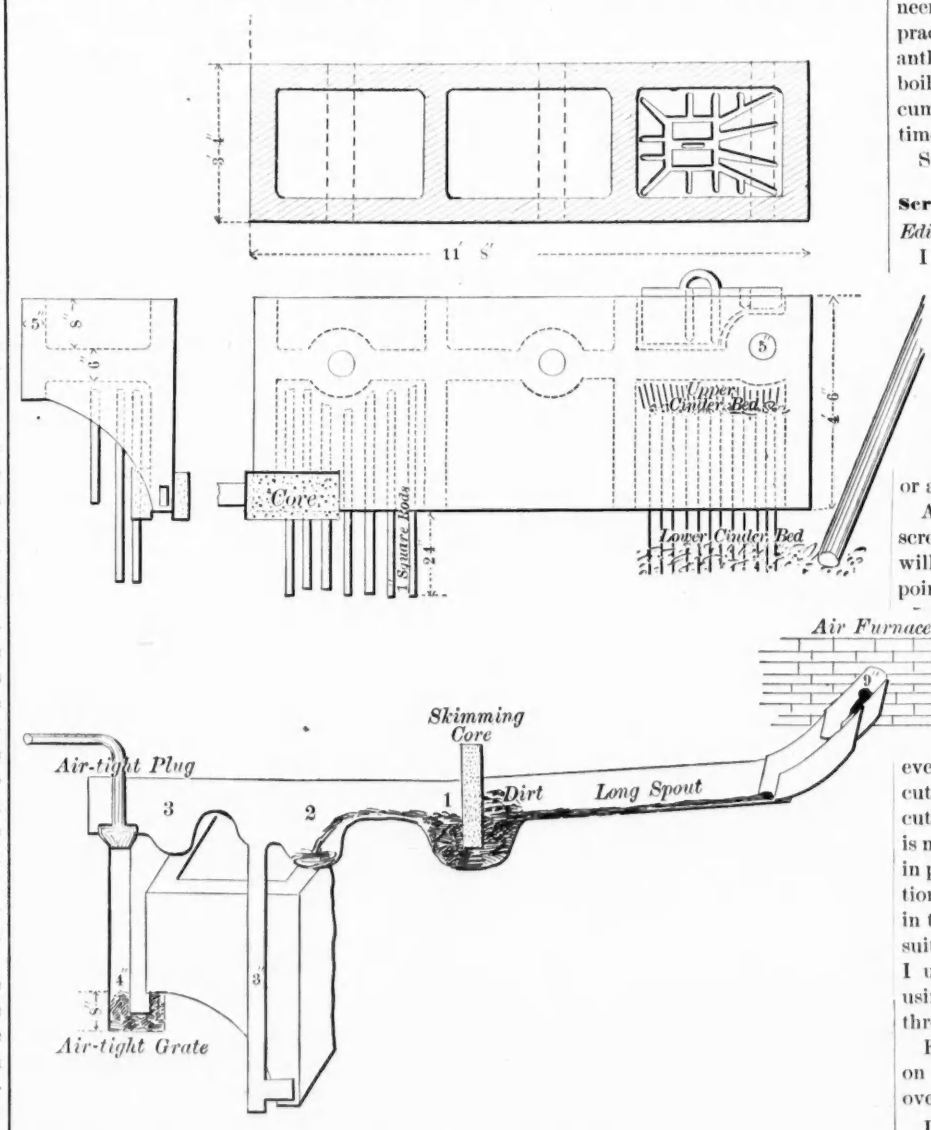
Fig. 1.

Fig. 2.

Method of Making a Heavy Green-Sand Casting.

By Thos. D. West.

Nearly two-thirds of all castings lost are lost on account of improper methods of making and placing gates and runners. The best method of gating green-sand moulds is to make the runner as short as possible, as it does not take a very long time for iron, when running against, or on the sand, to cut or wash it away. It is a good thing where you have a large quantity of iron to run through a gate, to place cores against your pattern where the wash of the iron is; or mix some flour in the facing sand for the dangerous sections, and, if you can get at it, put in some nails having the heads even with the faces of the moulds.



The gate and runners and mode of moulding the casting as shown in the cut, can be relied on as presenting a safe plan for any casting of a similar construction. This casting weighed about fourteen tons, and, being made in green sand, the utmost thought and caution were required to make a success as the casting was not a plain block, but a casting that had all the worst features of a green-sand mould to contend with, including corners, pockets, projections and flanges in both cope and bottom part, with a depth of over four feet in the ground.

The runners and gates were all made in cores, and rammed up with the mould. Being obliged to run this casting direct from the air furnace, as there were no large ladles nor chance to build a reservoir to hold the iron, I contrived the runners and basins, as shown, to let the iron into the mould should it come faster than calculated for. At the same time, if any lump should happen to choke up the tapping hole and make it come slower, there would be no chance for the air to blow out at the gate and start the mould blowing. As the iron came down the long spout it filled up basin (1), which has a core sunk in it to hold back the dirt, so that it is all clean iron that goes into the mould. The basin (2) is the main runner, as it takes the iron to the bottom of the mould. Should the iron come too fast, it will flow over into basin (3). When the basin is full lift out the iron plug, and the iron goes into the mould. Should the iron come slowly afterwards so as not to flow over into basin (3), and the mould is not filled up to the level of this gate, the air cannot escape, as there will be eight inches of iron in lower angle gates.

I conceived the idea of this gate from a street sewer that was made to keep back the stench. Where iron went into the mould, there were set cores the shape of the pattern to prevent any washing. The cut shows how the projections were rodded and vented. All corners were well nailed and rodded with small-sized rods, and the sand for the face of projections was mixed, one-third sharp sand, and rammed tightly. Instead of having wooden bars to lift the pockets out of the cope, iron frames were made the shape of each pocket and bolted to the cope. The facing sand for the cope was mixed one to twenty of flour, and when the cope was finished it was well wet with molasses and water, while a fire of shavings and chips was made under it until the surface was dried like a dry-sand mould.

LETTERS FROM PRACTICAL MEN.

Blowing Off Boilers.

Editor American Machinist:

The articles from week to week in the American Machinist on the care of steam boilers, by "Engineer" and others, are timely and of much benefit to the many readers of the paper. While the advice may be good, there are many cases where it cannot be carried out. For instance, in the American Machinist of July 23rd, "Engineer" says: "I have seen engineers draw their fires and in a few minutes after blow off the boiler, and as soon as empty fill at once with cold water in order to cool them quickly, as they say." This he says is an unsafe practice, which I admit to be true. In the anthracite coal fields there are many boilers, and they are examined every six months by the State boiler inspector or his assistant. At a colliery where there are eighteen boilers in a battery working to full extent, and at a time when it is almost impossible to spare them, word will be received at colliery on a Saturday afternoon at three o'clock: "Have six boilers blown out and ready for inspection by Sunday morning six o'clock," signed by the boiler inspector. Query: What is an engineer to do under such circumstances? In a practice of over nine years as engineer in the anthracite coal fields, I do not remember the boilers being blown out under any other circumstances, except for repairs in an idle time.

Observer.

Shenandoah, Pa.

Screw Cutting without a Backing Belt.

Editor American Machinist:

I see some queries in your valuable paper in reference to cutting threads on a lathe without a backing belt. It can be done in the following manner on all threads without a fraction, such as 5, 6, 9, 18, 11, &c.: On such threads run the cut as far as wanted, stop the lathe, unlock the nut and run the slide back by hand 1, 2, 3, or 4 inches, or as far as desirable to suit work.

Almost all lathes are furnished with lead screws of 2, 4 or 6 threads to the inch; so it will be seen that in stopping the lathe at any point, unlocking the nut, and moving the slide back by hand one, or any number of inches, to suit the work, the tool will be in the right position to suit the thread. It will not do to move the slide back $1\frac{1}{4}$, $1\frac{1}{4}$ or $1\frac{3}{4}$ inches, but it must be moved by even inches, when there will be no trouble in cutting threads without a backing belt. In cutting threads, such as $9\frac{1}{2}$ or $10\frac{1}{2}$ per inch, it is necessary to move the slide by two inches in place of one inch. By so doing, the fractional $9\frac{1}{2}$ threads per inch being 19 threads in two inches, the slide will be in position to suit the thread. When I worked on a lathe I used this method, and never thought of using a backing belt only on very broken threads.

For convenience of measuring, lay a rule on the lathe shears so that the slide will pass over it.

J. S.

Lambertville, N. J.

The Inch Plan in Cutting Screws.

Editor American Machinist:

I have noticed several inquiries, and answers to the same, pertaining to the method of cutting screws in the lathe without a reversing belt, but have noticed no reference to the "inch plan," *i. e.*, running back a certain number of inches from the place of stopping. The operation is as follows: After having turned your work to the correct size, place the thread tool in position and run over the thread once; then stop the lathe and disconnect the nut and run the carriage back by hand a certain number of whole inches from the place where the carriage stopped, irrespective of the position of the lathe head or screw gears. Then the nut will be in

position to connect, and the tool will follow correctly.

The above plan will answer only when cutting threads without a fraction. The reason for this method will be apparent when we remember that in running the carriage back one inch, we move the nut over a certain number of whole threads on the screw, and the tool over a certain number of whole threads on the work, or, in other words, the threads coincide every inch.

In cutting fractional threads, it is necessary to run back a sufficient number of inches to make the combined fractions amount to one thread. For instance, to cut 11½ threads, the carriage must be run back two inches or twenty-three threads on the work, otherwise the tool would come in the middle of a thread.

Newburg, N.Y. Frank A. Rider.

Annealing Steel.

Editor American Machinist:

The rotation of the molecule causes it to assume a spheroidal form, with a longer diameter at its equator and a shorter diameter at its rotating axis. In rolling a bar of iron or steel, the rolling action tends to draw the molecules, with their equators (long diameters), in parallel lines to the length of the bar.

The axis of the molecule (short diameter) is also its electric path; consequently, the normal position of the molecules in a bar of iron or steel is, with their electric axis, in parallel lines with its length, and with their equators across the bar; hence, the molecules in a rolled bar of steel are in an abnormal position, and must be changed, in order to secure the full efficiency of the metal.

The operation of hammering steel leaves the molecules in easy position, and for this reason they require adjustment.

The caloric escapes from the molecule by way of its axis; consequently, rapid cooling causes the molecules to assume the abnormal position, with their axis across the bar.

The act of annealing is heating the metal to a certain temperature and allowing it to cool slowly.

Temperature is a phenomenonal indication of molecular velocity; therefore when we raise the temperature we increase the molecular activity, and by doing so we enable the molecules to assume their normal attitude in the structure. Now, as before explained, if we cool the bar quickly, the molecules are again drawn into an abnormal position; therefore in annealing steel it should be properly heated and permitted to cool slowly. If carbon be present during the act of annealing, the metal will be more highly carbonized, and if oxides are present, the metal will be decarbonized; but neither of these phenomena are a part of the process of annealing. Jacob Reese.

Pittsburg, Pa.

Diagrams from Compound Engines.

Editor American Machinist:

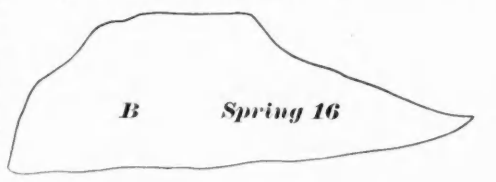
F. F. Hemenway, in a recent communication says: "If some one would give us a series of diagrams from automatic and compound engines, taken just as they are working every day, and without special preparation of parts, they would be interesting." I herewith contribute a pair, marked A, from a compound engine, also a pair marked B, from a similar engine built by the same makers, which I send for the purpose of comparison.

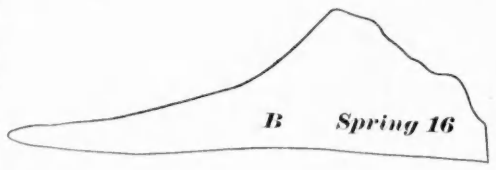
The following data is for engines from which diagrams A were taken: Cylinders, 14¼″×30″ and 28⅛″×30″; revolutions, 58; boiler pressure, 85 pounds; estimated clearance in high-pressure cylinder, long end, 15 per cent.; short end, 1 per cent.; low-pressure cylinder, long end, 10 per cent.; short end, 3 per cent. The cylinders are placed end to end with the valve across the top over the dividing line of the two cylinders; the induction and eduction of both cylinders being performed by one valve. The engine was built in 1865, and was run by the writer for several years previous to 1879.

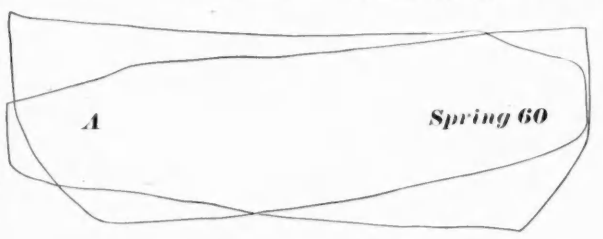
The engine from which cards B were taken is of same pattern, but rather smaller, being: 14″×28″ and 28″×28″; revolutions, 85; steam pressure, 105 pounds.

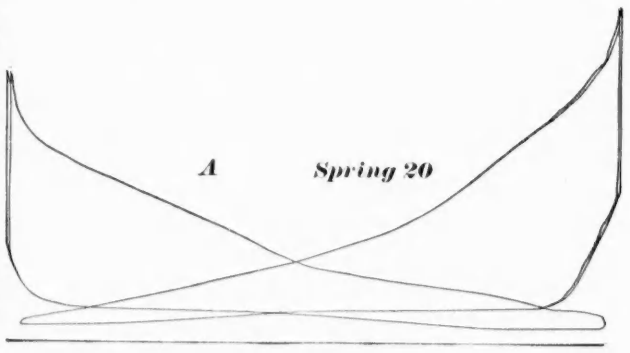
When I took charge of the large engine (cards A), it was giving a great deal of trouble, developing but little power and pounding very badly. About every six weeks or two months it would break a wrist pin or cross head. At first I could make but little improvement, but after getting an indicator, I was able to study its action, and finally brought it to its present condition. The first cards taken from it were similar to those marked B, taken from the smaller engine, which, after running several years, was replaced by an automatic engine at a great saving in fuel. C. E. Jones.

Manual Training School,
St. Louis, Mo.









Making Milling Cutters.

Editors American Machinist:

For various reasons, such as poor steel, overheating, improper grinding, etc., much trouble is experienced in getting milling cutters to work satisfactorily. The writer had some experience (sad, sometimes) with milling cutters, and for some reason was unsuccessful at first, but found that by observing the following directions, cutters "as good as any," can be made in any shop where they have one good lathe. Too much care cannot be taken in selecting the steel for milling cutters. It should be forged at the lowest possible heat, and when forged to size should be well hammered until cold. After heating again, it can be annealed in a box (an annealing furnace is better), filled with equal parts of sawdust and pulverized charcoal. Seal the box and let it remain for 48 hours. If the steel is of a good quality, it can then "be cut with a knife." Bore the hole $\frac{1}{64}$ smaller than the size; turn the cutter to $\frac{1}{16}$ of the size required, then drive out the mandrel; replace it again just sufficiently tight to prevent its slipping (to heat it before replacing it would be all the better), when it is finished to $\frac{1}{64}$ the finished size. After cutting the teeth, temper it by heating in a crucible of lead to the heat required to harden it (which can only be determined by experiments with a piece of the same steel). Mix a preparation of water (soft water preferred), in proportion of ½ pint of salt to 1 gallon of water, with the *chill* removed with a piece of hot iron. Take three pieces of wire ⅛″ thick; twist them together to form a handle to within 1 inch of the end; bend the ends at right angles with the handle; heat the cutter and insert the handle through the hole, and you have a "tongs" that will allow the water to come in contact with all parts of the cutter at once. *Dip the cutter squarely;* polish the cutter with *dry* emery paper, and draw it to the temper desired. To grind the cutter, fasten a cast brass plate, ⅜″ or ½″ inch thick, with screws from behind the face plate on a lathe; face it true; place the cutter on; run the tail stock spindle up to bear against the cutter (place a piece of soft wood between the cutter and center); true it up then with muriatic acid and soft solder; solder it to the plate at *one* point; remove the tail stock, center, and solder the cutter at four points opposite each other, taking care that the solder does not get back of the cutter. Place a small emery wheel in the slide rest of the lathe, and grind the face and hole of the cutter; remove the solder by heating, reverse the cutter, and grind it to the proper thickness.

Young America.

Waynesboro, Pa.

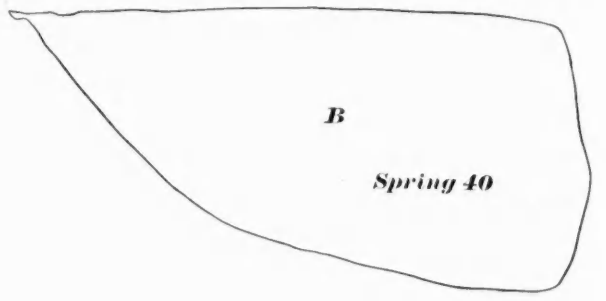
Experiments with Belts.

Editor American Machinist:

Mr. Webber is mistaken if he supposes I have assailed his rule for the driving power of belts. I have simply pointed out that his rule and his recent experiments do not agree—and they do not.

I have not a complete record of General Morin's experiments at hand. In the report of Briggs and Towne, his value for the co-efficient of friction is given as I gave it in my last. Mr. Webber's deduction of the co-efficient from his experiments does not agree with mine, because he uses a wrong method. He has apparently divided the weight held by the sum of the tensions on the two sides of the belt, and taken the result for his co-efficient. Such a method will not give a result within four rows of apple trees of the truth. Let him make the proper substitutions in the correct formula, and he will probably attain the same result that I did.

New York. Fred. A. Halsey.



"Mogul" and "Consolidated" Locomotives—Mixtures for Etching Metals.

Editor American Machinist:

In your issue of July 23rd, in answer to question No. 7 of H. E. G., Robella, Pa., asking meaning of the terms "Mogul" and "Consolidated" as applied to classes of locomotives, you reply that they are purely fanciful and have no recognized meaning. May I offer the suggestion that among locomotive and railroad men generally, these terms are now recognized as follows:

Mogul—An engine having three pair of coupled driving wheels, and a single pair of leading truck wheels. The main rod drives directly to the center pair of driving wheels; the center and trailing driving wheels are equalized with each other, and the leading driving and truck wheels are equalized with each other, the equalizing lever being directly under center of saddle.

Consolidated—An engine with four pairs of coupled driving wheels and a single pair of leading truck wheels; the three last pairs of driving wheels being equalized together, and the first pair being equalized with the trucks. On the Pennsylvania Railroad these engines were dubbed "Modoc" for short.

While in the C. B. & Q. laboratory at Aurora, Ill., I found the best mixture for etching evenly and uniformly to be, viz.:

For steel, 50 parts water, 40 parts sulphuric, 10 parts nitric acid.

For iron, 50 parts water, 45 parts sulphuric, and 5 parts hydrochloric acids.

For brass, 50 parts water, 40 parts nitric, 10 parts hydrochloric acids.

Suspend articles to be etched one-quarter inch below surface of bath, etching side down. Heat bath over same bath to 180° F.; immerse for fifteen minutes after bath is hot.

Wm. O. Webber,
Supt. Allen Paper Car Wheel Co.
Pullman, Ill.

Steam Engine Nomenclature.

Editor American Machinist:

The steam engine has often been likened to a thing of intelligence, and it might also be said that it has a language. With the proper instruments in hand and a knowledge of their use, this may be easily understood, and the engine, great or small, will tell you what it is doing.

But to the masses this is not fully understood, and the result is that engines, as they are found in general use, do not get credit for what they do; and, if you will allow me, I will attempt to show to what extent this goes.

One manufacturer builds a 10″×16″ engine and calls it a 20 horse-power; another builds the same sized engine and calls it a 30 horse-power. In nine cases out of ten the latter will be censured for attempting to deceive his customers by overrating his engine.

A careful test will probably prove him to be correct; but to many an indicator card has no meaning and furnishes no evidence of the power of the engine. To this class there are other tests more convincing, to one of which I will allude.

The unmistakable value of a cubic foot of water falling a given number of feet accounts for the fact, perhaps, that the various makers of water wheels have harmonized so nearly as to the power of their respective wheels.

The millwright puts in his turbine or other kind of water wheel, and demonstrates that with a given amount of water and given head he has 40 horse-power. This is applied to a circular saw mill, and when regularly run cuts from 8,000 to 10,000 feet of lumber per day.

A neighbor concludes that he will go to the timber with steam power, in place of finding another waterfall and taking the timber to the power. So he buys one of the first-named 20 horse-power engines and sets it to work, driving the same sized saw mill as the one driven by water; and to the astonishment of all, he is able to cut as much lumber as can be done on the water mill with its 40 horse-power wheel.

How is this to be accounted for? Simply by the fact that the man with his engine carries 110 pounds of steam and runs his engine at 150 revolutions per minute, and as a result he gets 40 horse-power out of his 20 horse-power engine.

I am aware that it is not every style of engines that will work up to this ratio of the nominal power, but one that is properly constructed will do this, and, as all know who have had experience with saw mills, such engines are always run to their maximum capacity.

I have often thought that there would be the same propriety in giving a tabulated rating of power for a given sized engine working at

varying speeds and under varying pressure, that there is for giving such a table to show the power of a given sized wheel under certain heads of water. The one is as easily demonstrated as the other, and quite as important to the purchasers of either.

My object in this is not to draw any disparaging comparisons between the two, but simply to give the steam engine credit for what it does. QUIRK.

Chattanooga, Tenn.

Measuring by Decimals of a Foot.

Editor American Machinist:

In your issue dated July 30th, Olin Scott speaking of the metric system, says he learned in Newark, N. J., that in several large establishments reamers, mandrels, etc., were measured by the *hundredths of a foot*. This used to be the case, but I believe it has been abandoned, except, perhaps, the old reamers may be kept for repairs.

These measurements were used entirely for diameters, and never for lengths. Even for diameters their use was limited to .12 of a foot, and under.

The reason for adopting this system, as near as I could ascertain (and I had a good opportunity of learning, as I was employed for a number of years by a large shop in Newark—the last four or five years as superintendent), was that $\frac{1}{8}''$, $\frac{1}{2}''$, $\frac{3}{4}''$, $1''$, etc., iron could be turned to .03, .04, .06, .08, etc., of a foot, there being 96 eighths of one inch in a foot, so that the difference between $\frac{1}{8}$ of an inch and one-hundredth of a foot was one twenty-four hundredth of a foot. When .12 of a foot was reached the measurement corresponded with $1\frac{7}{8}$ inches, and from that up the hundredths were not used.

Several years since we found so much inconvenience that the system was abandoned for eighths and sixteenths, and found a decided gain in every way.

Erie, Pa. C. C. COLLINS.

Blue Print Sections for Materials.

Editor American Machinist:

During the heat of the discussion on the drawing question in your valuable columns, I wanted to send you some hints on the subject, as bearing on a proper method of showing *sections* of various materials in a blue print tracing. One of your correspondents in a late issue of the AMERICAN MACHINIST, seemed to think it difficult to show *sections* on a blue print. I therefore send you a copy of the standard sections for materials, as used by the Pennsylvania R. R. Co., and the method of numbering, etc., which I had a hand in suggesting when connected with the company.

Hartford, Conn. A. H. CAMPBELL.

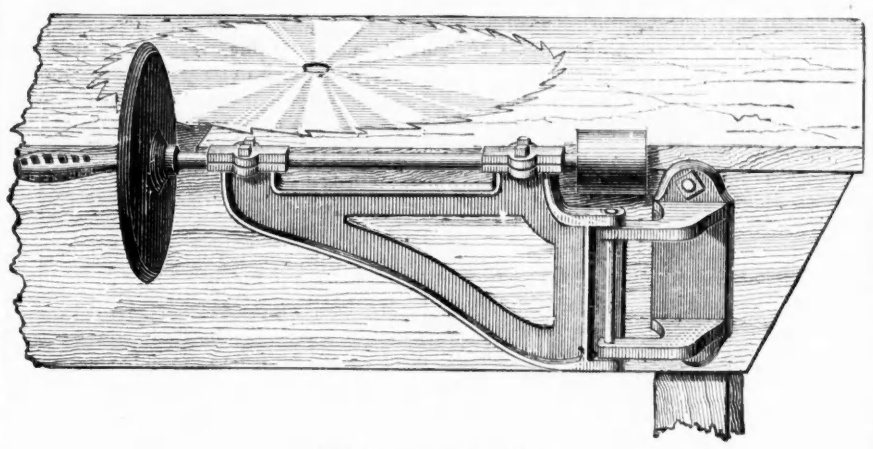
[As we cannot show a blue print in the AMERICAN MACHINIST, it is proper to add that the one accompanying the above letter is very clear and intelligible.]—ED.

Saw Grinding Machine.

In our issue of March 5th, 1881, we presented a cut of a new saw grinding machine, at the same time stating that it had mysteriously come into our possession, and we were unable to give the maker's name or address. We have since learned that it is made by T. Hodgson, Amherst, Nova Scotia, and reproduce the cut herewith for further explanation.

A strong bracket is bolted to a bench, only part of which is seen in the engraving. To lugs cast on this bracket is hinged a crane carrying, in bearings on the top, a steel arbor, at one end of which, immediately over the hinge, is a driving pulley, and at the other end an emery wheel. The arbor is so long as to give it about three inches of end play. The emery wheel is secured in the usual manner, but the arbor extends through the nut some three inches to the left, and on this is fitted a small pipe or sleeve, very much like the pipe of a carriage axle, and on one side of this pipe is cast the handle seen in the engraving. The saw, whether long or circular, is placed on the bench as seen in the engraving, and by means of the swinging motion the wheel works in the depth of the tooth, while the end play of the arbor allows it to work along the length of it.

The arbor can be run either from above or below, but the part of the belt that runs on to the pulley should run vertically or "plumb;" and as the pulley is fairly over the hinge of the machine, the swing of it has no tendency to throw the belt. Even a rapid end movement of the arbor will not throw the belt, as it leads up to the crown of the small pulley, while it traverses the driving drum, which should be quite flat on the face.



SAW GRINDING MACHINE.

An Improved Bicycle.

Some months ago an enterprising man constructed a bicycle, just the reverse of those heretofore in use. The small wheel was placed in front to prevent the momentum of the rider from throwing him forward, when the machine would come to a sudden stop, or a partial stop, also to enable it to be guided more easily. The first form of the new bicycle having been well received, some improvements have been devised, which are shown in the accompanying cut of the New Star Bicycle.

The manufacturers claim for this machine that while they have made no sacrifice of strength or durability for the purpose of securing phenomenal lightness, they have by the use of rolled and hammered steel, phosphor bronze, etc., and also by judicious design and construction, secured the combination of reasonable lightness with strength and durability. Great smoothness of motion is said to result from the use of the heavy rubber tires, which are secured to the wheels by a peculiar device. One of the noticeable features is the use of levers on clutches, operated by the hands, in place of the old foot crank. It is said this is a much easier way of propulsion, and also that its adoption does away with the necessity for measuring each particular rider for a bicycle: one of these machines being right for the smallest boy or the largest man. Many other improvements are claimed, such as an improved mode of fastening the spokes in the wheels; an improved saddle, a construction which renders mounting and dismounting, as well as steering and turning, much easier.

These Improved Bicycles are manufactured by the H. B. Smith Machine Co., Smithville, Burlington Co., N. J.

AN IMPROVED BICYCLE.

Newly Incorporated Companies.

NEW JERSEY.

Tombstone Water Company, Camden; Hamilton Disston, Edward J. Matthews, Charles E. Etting, and others, incorporators; Capital, $500,000. To sink wells, shafts, and other appliances to procure water; to build aqueducts, and reservoirs, erect pumps and other necessary machinery and engines for distributing water, etc.

Crescent Pottery Company, Trenton; William S. Hancock, Charles H. Cook and William S. Hancock, Jr., incorporators; Capital, $100,000. To manufacture and sell all kinds of pottery ware, and the materials used in connection therewith.

Fairbairn Manufacturing Company, Elizabeth; William M. Fairbairn, William D. Overell, Robert O. Little, and others, incorporators; Capital, $200,000. To manufacture and sell steam boilers, their appliances and apparatus, and the Fairbairn Grate Bar.

Standard Underground Electric Company, Camden; William B. Eltonhead, Samuel P. Ferres and E. V. Machette, incorporators; Capital, $2,500,000. To manufacture, and license others to manufacture, an improvement in underground conduits for telegraph conductors, and water-proof non-conducting chambers, tubes, etc.

MAINE.

Chandler and Silver Water Motor Company, Lewiston; J. S. H. Cobb, M. A. Chandler, L. S. Chandler, A. M. Gardner and N. W. Harris, incorporators; Capital, $50,000. To manufacture and sell water motors, elevators, steam engines, and carry on a general machine business.

NEW YORK.

Holmes and Wessell Metal Company, New York; Fred'k Schonnard, C. E. L. Holmes, G. Livingston Morse, Chas. Wessell and Geo. C. Edwards, incorporators; Capital, $100,000. To manufacture and deal in metals and their alloys, and articles made in whole or in part thereof.

The Tonawanda Valley and Cuba Railroad Company. Directors: Bird W. Spencer, Chas. G. Barber, Royal C. Vilas, Edmund S. Bowen, R. G. Taylor, W. S. Bissell, Daniel O'Day, Elmer M. Bond, J. V. D. Loomis, Jno. J. Carter, Wm. N. Davis and Chas. J. Elmer; Capital, $250,000. To construct, maintain and operate a railroad from the village of Arcade, Wyoming County, to the village of Cuba, Allegany County. Length of road 30 miles.

The Standard Railway Joint Company, New York; Capital, $100,000. To manufacture and sell nut locks and joints of every description, to be used in laying railroad tracks.

The Buffalo Nut and Bolt Company, Limited, Buffalo; Jno. B. Perkins, Robt. C. Hickock, F. H. Duckwitz, and others, incorporators; Capital, $30,000. To manufacture and sell nuts, bolts, washers, screws and rivets, and other articles from iron, brass, composition and other metals.

The United States Motor Company, New York; Chas. B. Hall, William J. Horton and Henry Cummins, incorporators; Capital, $1,000,000. To manufacture and sell electrical and other motors.

Anderson Caloric Engine Company, New York; Luis Anderson, John A. Svenston, Jas. W. O'Rourke, John A. Frees and Jas. Cantwell, incorporators; Capital, $6,000. To manufacture and sell caloric engines.

ILLINOIS.

Quincy, Vandalia and Eastern Railway Company; principal office, Jerseyville; Jas. L. Bennifill, Geo. W. Ware, John N. English, Wesley Park, Horatio N. Belt and Royal J. Whitney, incorporators; Capital stock, $5,000,000. To construct and operate a line of railroad from a point at or near Quincy, in Adams County, to or near Vandalia, in Fayette County, or to or near Greenville, in Bond County, all in the State of Illinois.

Belt Line Railroad Company; principal office, Chicago; H. B. Ledyard, A. L. Osborn, Albert Keep, Marvin Hughitt, Chas. E. Perkins, Thos. J. Potter, Wm. K. Ackerman, Jos. F. Tucker and Elijah Smith, incorporators; Capital stock, $5,000,000. To construct and operate a line of railroad from a point on the shore of Lake Michigan, at or near South Chicago, running thence westwardly through the towns of Hyde Park and Calumet; thence northwesterly, to a point on the Chicago, Burlington & Quincy Railroad, in the town of Cicero; thence northerly, to the south line of the town of Jefferson; thence northeasterly, to a connection with the track of the Chicago & Northwestern Railroad Co., near their intersection with the north limit of the town of Lake View; thence east to Lake Michigan, all in Cook Co., Illinois.

Detroit, Warsaw and Western Railway Co.; principal office, Urbana; Francis M. Wright, Geo. W. Curtiss, Charles L. Burpee, Albert Emerson, Thomas A. Lewis, Samuel R. Reed and Lineas B. Tinder, incorporators; Capital stock, $2,500,000. To construct and operate a line of railroad from the State line, in town 24, in the county of Iroquois, and from thence running in a southwesterly direction, through the counties of Iroquois, Vermillion, Champaign, and thence in a westerly direction, through the counties of Piatt, Macon, Logan, Menard, Cass, Brown and Adams, to the Mississippi River, at or near the City of Quincy, all in the State of Illinois.

Vermillion and State Line Railroad Company; principal office, Danville; Alfred A. Thomas, Edward Corse, Edward V. Springer, John Mackinon and Jos. B. Mann; Capital stock, $100,000. To construct and operate a line of railroad from a point on the south line of Vermillion County, near the crossing of said line by the Danville and Southwestern Railroad, to a point where the Frankfort and State Line Railroad intersects the Illinois State line in Vermillion County, all in the State of Illinois.

Northwestern Corn Malt Company, Chicago; William A. Leary, Chas. B. Oglesby and Andrew J. Wright, incorporators; Capital, $100,000. The manufacture of corn malt, meal, feed, etc.

Rolling Wave Carriage Company, Chicago; W. X. Stevens, J. Sterner and J. M. Birchler, incorporators; Capital, $50,000. To manufacture, buy and sell carriages and other novelties.

Brush Electric Light Company, Chicago; Robert Law, Francis C. Cross and Joseph Sears, incorporators; Capital, $500,000. To manufacture, produce and furnish electric light for the purpose of illumination of buildings, streets, etc; also to manufacture all such machinery, apparatus, etc., pertaining to the aforesaid business.

Western Steel Company, Chicago; James D. Sturges, C. B. Nelson and A. B. Seymour, incorporators; Capital, $30,000. The manufacture of and dealing in horse shoes, metals, metal articles and merchandise.

The Bostwick Folding Iron Gate Co., Chicago; James H. Raymond, W. A. Smith and Henry Dibble, incorporators; Capital, $100,000 The manufacture and sale of folding iron gates in the State of Illinois.

The Paris Heberling Running Stitch Shirring Machine Co., Chicago; W. D. Gibson, Jos. B. Long, James A. Kingsbury, and others, incorporators; Capital, $25,000. To manufacture and sell shirring machines.

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NEW YORK, AUGUST 13, 1881.

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Two Kinds of Manufacturing Companies.

The gratifying activity in all manufacturing industries is stimulating the starting of new mills and workshops at a rate which, if kept up, will in a few years place the United States at the head of manufacturing countries. At the same time, the growing excellence of our industrial products is making it more and more difficult for foreign nations to compete with American wares in the markets abroad. The fears of over-production, which a certain class of slow conservatives are never tired of exciting, may, in some degree, be allayed by this increasing advantage in trading with foreign customers. There is no good reason apparent now why the rapid expansion of productive enterprises should be checked. So long as each new venture has a substantial foundation to rest upon, there need be no public alarm about their multiplicity. The tendency of the times is largely towards co-operation in the form of stock companies as a means of organizing new industrial enterprises. As few individuals having the will, possess singly the means required to start a large manufacturing establishment, they find it most desirable for several of them to unite their capital and abilities, get a charter of incorporation, and start business with suitable facilities to compete with concerns already enjoying the advantage of extensive manufacturing plants and established trade. It is becoming very difficult for concerns with small capital to start fresh and new, and compete successfully with old and wealthy houses in the same business. Co-operation presents a way to surmount the difficulties. Since the advent of extra prosperity in general business, however, the incorporation of manufacturing companies and the sale of shares of stock thereby created has become, in many instances, a lucrative business of itself, pursued to the partial or frequently the total neglect of the objects named in the charters of incorporation. The basis of most of these ventures consists of a patent or patents, a few experiments and a large amount of pretension. The incorporation of a general or central company, owning all the patents for the article which it is ostensibly formed to manufacture, is then followed by the incorporation of as many local companies, owning certain limited rights in the original invention, as can prudently be manipulated. The general public are thereby deceived into investments which, in nine cases out of ten, produce no legitimate returns. Frequently the original invention which such companies purport to manufacture, has distinguishing merits which if developed would form the nucleus of one good industrial establishment. It is, however, the *real* object of a stock company rather than its defined object which makes its certificates a desirable investment, and it often requires considerable discrimination to distinguish between pretensions and earnest manufacturing enterprises.

Midsummer Meeting of the Mechanical Engineers.

The midsummer meeting of the American Society of Mechanical Engineers to be held at Altoona, Pa., on the 10th, 11th and 12th of August, bids fair to be a successful meeting. The reputation of Altoona as a summer resort, situated as it is among the Allegheny Mountains, and the pleasant excursions which have been planned, should make the town a desirable place to visit during the hot days of summer.

Education in Drawing.

One of the greatest needs of the day is practical mechanical education. Two few who work in machine shops are men of good mechanical knowledge. The valuable literature of the shop is recorded in mechanical drawings. How to make these drawings ought to be one of the first considerations of an ambitious mechanic. The lessons on mechanical drawing now being presented by Prof. John E. Sweet in the AMERICAN MACHINIST afford the best chance we know of, for young men, or men of middle age, to take up the study *without a teacher*. We are glad to learn by letters we have received that there are many who are now laying firm hold of this opportunity. On page 4 this week will be found another of this series of lessons, which we feel assured will help many a mechanic to advancement.

Some Liberal Gifts.

A liberal or college education is of great advantage to a young man of ambition and natural ability. The cost of such an education, however, deters thousands from entering upon a course in some college or university. Private endowments are doing much to open the way to more of the rising generation to secure a college training. Among the latest instances of liberality in this respect is the donation of $30,000 to Alfred University of Alfred, Alleghany county, N. Y., and $10,000 to Milton College, of Milton, Wis,, by the well-known successful mechanical engineer, George H. Babcock, of the Babcock & Wilcox Company, New York. He has also offered another $10,000 to the latter institution when other friends of the college raise an additional $10,000, which they are now engaged in doing.

Mr. Babcock says he has experienced the value of a college education, and wishes to increase the facilities for young men to avail themselves of college advantages.

The Horse Power of Boilers.

A horse power is a definite quantity, being the raising of 33,000 pounds one foot high in one minute of time. This was established by Watt, and has since come to be the accepted standard in England and in this country. It is comparatively easy to determine the amount of horse power developed by a motor—as, for instance, a steam engine—and it is also possible to predicate with reasonable accuracy the probable power of a steam engine. It is by no means so easy, either to determine or predicate the horse power of a boiler. When the term horse power is applied to a boiler the intention is that it expresses the power to be exerted by a steam engine, for which the boiler would furnish steam; or an equivalent evaporation, where the steam is used for other purposes. It is well known that only a small percentage of the heat liberated in the furnace is utilized in the engine, and that the greater part of the loss takes place in the engine.

It might at first appear that the engine could be used to measure the capacity of the boiler, as by the ability of the latter to furnish steam to the former. This would be well enough if the proportionate loss was alike in every steam engine. Since, however, one engine may and does use twice as much steam as another in doing the same work, unless the same engine is used for measuring all boilers, we shall be continually changing our standard of measurement.

As manufacturers *will* build and rate boilers by the horse power, it is necessary to fix upon some standard engine performance by which to rate them. We believe the evaporation of half a cubic foot of water under a pressure of from 60 to 80 pounds per square inch, may be fairly taken as the equivalent of a horse power. Some engines will doubtless require much more than this, but on the other hand very many require materially less. Assuming this as the standard unit of measurement, there are other things to be considered before the proportions of a boiler for a definite horse power can be determined. One of these, and the one that has the greatest influence on the results, is the dimensions of chimney. Other things being equal, the higher the chimney the better the draught: and hence the more coal may be burned per square foot of grate surface. It is evident that there must be some height of chimney in order to burn the coal at all; and as the capacity of the boiler is to a great extent determined by this height it should be fixed at something—say at not less than 80 feet. Under these conditions, in boilers of good construction, 12 feet of *effective* heating surface is equivalent to one horse power. The effective heating surface of the ordinary types of land boilers may be taken: For cylindrical flue or tubular, ½ the external surface of the shell added to the internal surface of the tubes or flues. For internally-fired boilers: the interior surface of the fire box with the tube and fire-door openings subtracted and the interior surface of the tubes added. This does not, of course, apply to boilers worked with a forced draught, as in the case of locomotive and marine engines, where the height of chimney has but little to do with the draught, and where a horse power may be had from a very much less amount of heating surface.

Fusible Boiler Plugs.

At one time the safety of a boiler, so far as any danger arising from low water, seemed reasonably well assured by the use of the fusible plug. Experience has demonstrated, however, that this, like many other so called safety devices, is not to be depended upon. In some instances, the material of which the fusible portion of the plug is made seems to gradually lose its nature, or, more probably, the *base* of the metal gradually wastes away, its place being occupied by lime and other deposits, until it is well nigh impossible to melt it. In other instances, it becomes covered with scale and dirt, making it highly improbable that it will melt until the heat becomes dangerously high. So uncertain is it at what temperature such plugs will melt, that as safety devices they are of little use.

New Theories of Boiler Explosions.

Man is by nature inventive. From the remotest antiquity he has exercised this partly inherited and partly-acquired talent in one way and another, and up to the present time there is no reasonable probability that he will turn his attention away from what seems the great object of life. History for the most part makes us acquainted in a general way with the nature of human inventions until we get back beyond the time when history itself was invented. It is assumed that the pre-historic man did not do much in that way. Even poets have sung of the "birth-day of invention" in a way to suggest the belief that it only extends back to about the time when three-legged stools made their appearance, or when the fourth leg was added to the primitive three-legged affair; but there is not a particle of evidence to show that this idea is anything more than a poetic fancy at most. The fact stands out that the pre-historic man invented himself into history, whatever else he may have done in that line. Invention is good in its way if mankind uses it only for beneficent purposes. But mankind does not always so use it. In view of this fact, men ought to be prohibited from working in certain directions.

The individual who invented the steam boiler, or, correctly speaking, the "steam generator," is not known. Even if we assume the first boiler to have been a tea kettle, we are no nearer to settling this historical question. We know something of the clumsy arrangements that held sway a few years ago, and we also know that they had one stronghold. There was no danger of an explosion. Our ancestors did not invent explosions. There was not any inducement for one. Care was taken that the pressure on the inside should be so evenly balanced by that on the outside that a boiler could not tell which way to go if it let go. There were some drawbacks to this way of using steam, as, for instance, it did not do anything to help coroners. There wasn't much discussion over material, and it wasn't stamped with any signs going to show it would bear so many pounds to the square inch—if it was strong enough.

Notwithstanding the advantages of the ancient boiler, mankind were not satisfied. They had to invent something, and the stock being worked up in other directions, they took to boilers. It must be admitted that some good results have come from this, and it might have been well enough if some restless individual had not begun to invent theories of boiler explosions. We say theories, because it was undoubtedly advis-

able to have *one* theory. Of course it was necessary to blow up a boiler or two to see how they would go, and it was equally plain it would not do to say the trouble was that the pressure was too great for the strength. Such an admission would have been unscientific. Ordinary mortals would have lost all interest in the matter because they could have understood it. We think it will be admitted, without further argument, that it was necessary in the interest of science to invent *one* good square theory on the subject—something of course that no live man could understand. No exceptions could have been taken to this; besides it was reasonably safe. So long as the water had to get low before a boiler could refuse to hang together, it might with reason be expected it wouldn't be allowed to get low. It might have been left alone right here, and attention turned to making things generally strong and durable. This from the perversity of human nature would have resulted. There being but one horn to the dilemma, by any known process only a limited part of humanity could have been induced to cling to it. The others would have clung to the old-fashioned doctrine that a boiler let go because it wasn't strong enough to stand the pressure. Between the efforts of the theorists to keep the water up, and the efforts of the old fogies to keep the pressure down and the construction up, the boiler would have had a poor time in getting away.

But it was not left alone here. In a free country one man has as much right to invent theories as another. No man could hope to hold a monopoly of exploding boilers by low water. That single theory has borne fruit till the theories are past numbering. To-day boilers are allowed to scatter pieces of themselves around, not only by reason of containing too little water, but also by reason of too much water. Again, we are told they explode by having too much air, and, still again, by having too little air in the water. They explode because the steam is allowed to escape, and because it is not allowed to escape; because the plates are too heavy, and because they are too light. A mysterious, explodable gas is permitted to be generated, and the water is allowed to divide itself up into various geometrical forms which produce calamitous results. Normally innocent pumps cause all the trouble by attending to their duties, and worse trouble when they strike.

This is well so far as giving every one his choice without having his opinion crowded by others thinking the same way, but it gives the boiler too much chance. Instead of having to go in the good old-fashioned way, it—so to speak—takes its choice. No man can count all the ways in which death in the boiler stares him in the face, much less provide a means of escape.

Bad as this is we were getting used to it. If the matter had been allowed to rest even here, we might have taken an occasional explosion and submitted to the letting of it come by, or through, either or all these theories. But it is not to be left even here. An inventor comes forward with a new theory that cuts off the last hope. He is a Brooklyn man, and communicates his startling theory through the columns of the New York *Sun*. He says: "The space above the water being filled with steam, and the pressure momentarily increasing, the central column of steam becomes inverted, and, pressing downward upon the surface of the water, acts like a wedge, dividing the water in the center and pressing it against the sides of the boiler, thereby producing immense pressure at given points, instead of that uniformity which the ordinary test effects. Consequently the wedge of steam divides the water before it until the boiler is rent in pieces." He also accounts for the explosion when the safety valve is opened upon a theory of the steam acting as a spring suddenly released, and producing an "enormous" concussion.

Letting alone for the present the spring, the wedge theory is alarming. If there is to be let loose inside a boiler—in addition to all other well-known inventions having in view its final disintegration—one of the best known and mightiest mechanical powers, the case is hopeless. We don't believe the constituted authorities have any moral right to sanction the use of such an invention. There is misery enough lurking inside a boiler without it. It is not giving humanity a fair show. It is evident there is no limit to the acuteness of the wedge, and hence to its ability to separate things. The application may be made at present, but with improvements that will be made no possible construction can withstand it. The result of its general adoption will be the abandonment of every steam generator, of the ordinary type at least.

There is but one chance left. That is, that the inventor—who it will be noticed claims an inverted wedge—be required to reinvert it. That would bring the base against the water, and by a simple reversal of his theory would immensely strengthen and hold things together, instead of scattering them promiscuously. We offer this as an amendment. In the meantime we take considerable interest in the old fogies, who believe a boiler lets go because it is not strong enough to hold on.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(1) J. T. H., Halifax, N. S., asks: 1. Please inform me what sort of glue is used in making emery wheels? *A.* Various kinds of glue or cement are used, as pure glue; shellac, linseed oil and litharge; silicate of soda and chloride of calcium; oxychloride of zinc; oxychloride of magnesia, rubber, tanite, etc., etc. 2. How are buffing wheels made? *A.* Buff wheels are made by laying up, glueing and pinning sections of pine lumber, the same as for a pattern. Iron flanges are attached, as in the case of a wooden pulley. The wheel is then mounted in the bearings in which it is to be run, and the face turned true. It is then covered with leather from 3-16″ to 5-16″ in thickness, the leather being carefully glued to the wheel. The joint where the leather meets should be cut diagonally across the face of the wheel. After the glue is firmly set, the outside of the leather should be turned quite true with a sharp chisel. The emery is applied by covering a small part of the surface at a time with glue, spreading the emery over it, and pressing it firmly down with a smooth board. After the emery becomes hard it may be trued up, or the high places at the joints removed, by turning with an iron or steel rod. For fine polishing the wheel should be covered with flour of emery, and if a higher finish still is required, the wheel may be greased, and glazed by holding a flat piece of iron against it while running. For some purposes these wheels are used with nothing whatever on the leather. For coarser polishing suitable grades of emery may be used.

(2) J. G. B., Fremont, O., asks: 1. What are some of the causes of pounding in a steam engine? *A.* The causes are numerous. Some of them are: loose boxes, engine out of line, cross-head gibs loose, boxes loose, loose piston, connecting rod brasses bored out of truth, improper adjustment of valves, bad construction, etc., etc. 2. How shall I clean a ten horse power upright boiler? *A.* Allow the boiler to stand over night, let the water out and clean with scrapers through the hand holes, at the same time rinsing with a hose. It is generally quite difficult to clean such boilers satisfactorily.

(3) J. T. D., Portsmouth, Va., writes: I am using a hydraulic press for pressing car wheels, on and off, and every time I use the press I have to pry the ram back. When the press was new all that was necessary was to relieve the pressure, and the ram would be drawn back by a weight without assistance. I have added 50 lbs. to the weight with no better results. I have tried every remedy I could think of without success. The press has a capacity of 150 tons, and was built by the New York Steam Engine Co. in 1873. Please inform me what to do? *A.* When a hydraulic wheel press begins to work hard and sticks, the ram should be taken out and the leather packing ring carefully removed and examined. If it is not worn out, it should be carefully washed with warm water and castile soap to remove all the gum and dirt. It should then be allowed to dry by being exposed to a very moderate heat. After drying, the ring should be immersed in a pan of pure tallow or suet, barely melted, as a too high temperature is very destructive to leather. The pump and all its parts should be cleaned thoroughly, likewise the passages, and clean water put into the tank after it has been cleaned. After the leather packing has been made thoroughly soft and pliable by soaking in the tallow, it should be placed in the recess prepared for it, and a little pure graphite or black lead rubbed within the cylinder. By following these directions you will probably find that your press will work as good as new. Should the leather packing be worn out, or the life of the leather gone, make a new one of the best leather, being careful to make it not too thick.

(4) W. C. F., Cincinnati, O., asks how to make and use a liquid case-hardening mixture? *A.* One of our correspondents sends us the following, which he says is 100 per cent. better than anything else he has ever used: "Take an ordinary sand or plumbago crucible, large enough to hold two or three times the quantity of work you intend to harden. Fill the crucible half way up with equal parts of fine salt and cyanide of potassium; set it on the fire, and heat up slowly till fused. Now, having the pieces to be hardened ready, plunge them all in together, and for a thin skin of hardening five minutes will be long enough, but if you wish a hard and thick film keep them in for a longer time. Afterwards the whole contents of the crucible must be poured quickly into cold water, not less than 12 inches deep, as the articles should become nearly cool before reaching the bottom. If the pieces are finished before hardening they will come out a beautiful grayish white, and as hard as glass." It has been suggested by another correspondent that, instead of emptying the contents of the crucible into the water, thereby losing the material of the bath, that the pieces to be hardened be suspended in the bath in a basket made from wire netting, and when properly heated the basket, with its contents, can be lifted out and plunged into the water, thereby saving the material. The mixture is highly poisonous, and care should be taken not to inhale the vapors arising from it.

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MANUFACTURES.

W. B. Pollock & Co., Youngstown, O., are just completing a new boiler shop.

Every steam pump works is crowded with orders, most of them being several weeks behind in filling their orders.

The Rensselaer Iron Works, Troy, N. Y., have shut down four weeks for repairs. Nearly 1,000 men are thus provided with a vacation.

The silk mill at Allentown, Pa., is under roof, but $10,000 more must be subscribed to complete it according to original plans.

The New Union Pacific railroad shops, which are being built at Grand Island, Nebraska, will be the most complete that company has.

The Gilbert & Barker Manufacturing Co., Springfield, Mass., manufacturers of the Springfield Gas Machine, are building a brick addition to their shops, 43x37 feet, two stories high.

Hubbard & Blake Manufacturing Co., West Waterville, Me., are about to build new shops for the manufacture of axes, hatchets, chisels, and other edge tools.

The Long & Allstatter Company, Hamilton, Ohio, manufacturers of power punches, shears, etc., are at work on several heavy machines for the Gautier Steel Company, Johnstown, Pa.

B. F. Avery & Sons, Louisville, Ky., are building an extensive addition to their plow works, and will put in a 400 H.P. Porter-Allen High Speed engine.

The Iowa Iron Works, Dubuque, Iowa, employ about 150 men, and will soon make additions to employ 100 more. They build engines and boilers, and conduct a general foundry and machine business.

The Remington Paper Co., Watertown, N. Y., are about to put in two Root Sectional Safety boilers of 700 H.P. each. The Kentucky Wagon Manufacturing Co., Louisville, Ky., have also put in one of 760 H.P.

Hickox & Co., Cleveland, have accepted the plans from E. P. Allis and Co., of Milwaukee, for their new 800-barrel roller mill, and are now busily at work on the building. This mill will contain about fifty roller machines, and will be one of the finest in the country.—*Cleveland Trade Review.*

S. E. Prentiss & Co., 807 Lake Street, Cleveland Ohio, is the name of a new firm that has just purchased the business of A. S. Field & Co. They will manufacture Schofield's Pipe Couplings, Radiator Couplings and Reducers. These couplings require no lead or packing of any description.

Grant & Bogert, Flushing, L. I., have their new machine shop just roofed over. It is 200x45 feet, with a wing 45x45 feet. They already have twelve machinists at work, and will be ready to deliver engine lathes to customers early in November. They have already booked orders for a good number of lathes.

The Billings & Spencer Co., Hartford, Conn., employ one hundred men, and are crowded with orders for drop forgings and machinists' small tools. Their new 150 H.P. Hartford High-Speed engine gives them considerable more power than they had before, and correspondingly increases their capacity.

The taxpayers of Danville, Va., are enthusiastically in favor of the purchase by the City Government of the water power of the Dan River at that place. It is said that, by judicious improvements, more than 1,000 horse power can be secured, which the citizens propose to lease to different manufacturers at nominal prices.

The Lithgow Manufacturing Co., Louisville, Ky. (stoves, hollow ware, etc.), are putting up new buildings for foundry, finishing shops and office. When completed they will have the finest building for the purpose in the Southwest. They are putting in a Wright engine of 75 H.P., and a Root Sectional Safety boiler of 100 H.P.

Waterman's lifters for weighing down the engine by bringing the weight of the tender to bear on the drivers, instead of using heavy castings upon the footboard, are being tried on the Boston and Albany Railroad. Six of these have been already put on, and the other engines will probably be equipped from time to time, the arrangement being put upon the heaviest engines first.

The Webster, Camp & Lane Machine Co., of Akron, O., have completed their new foundry, 72x116 feet. It has two cupolas, 12 and 16 tons capacity respectively, provided with a large Baker Blower. In their machine shop they have recently added three new lathes and a Betts Machine Co.'s boring and turning lathe, having a swing of 16 feet across, and 6 feet high, with two tool posts.—*Industrial World.*

The Ashcroft Manufacturing Co., Boston, Mass. write us under date of July 21, 1881: "We sent out the following Tabor Indicators last week—Chas. T. Porter, Southwark Foundry and Machine Co., 2; Border City Mills, Fall River, Mass., 2; Edison Electric Light Co. (second order), 1; Westinghouse Machine Co., Pittsburgh (second order), 1; Musconetcong Iron Works, Stanhope, N. J., 1; Harris Tabor, Hartford, Conn., 1; Armington & Sims, Lawrence, Mass., 1; Seth Thomas Clock Co., Thomaston, Conn., 1, and received orders for the following: B. F. Sturtevant, 1; E. P. Robbins, M. E., 2.

The Babcock & Wilcox Co., 30 Cortlandt Street, New York, have just issued a new edition of their illustrated pamphlet entitled "Steam," which gives a fund of information for steam engineers, as well as specific information regarding their water tube boilers. This company has received orders for 72 boilers since the first of April. Among those lately ordered is one of 300 H.P. for the Brush Electric Light Co, Philadelphia, and one of 200 H.P. for the International Cotton Exposition at Atlanta. They supplied the Edison Electric Light Co. with two boilers, each 150 H.P., to go to the Paris Electrical Exposition.

The success of the system adopted by the International Co. for mining and dredging is assured. The use of the vacuum chamber, in which the vacuum is obtained by condensation of steam by means of a sudden ejection of water, has proved highly satisfactory, and the vacuum thus obtained has been found to be sufficient to raise the largest stones that can enter the suction pipe. The Whittier Machine Co., of Boston, are now building two machines of this class, one of a capacity to require a 30-inch suction pipe, for the Kennebec Dredging Co., of Maine; another, 18-inch, for the Georgia River Mining Co., of Georgia. The several (nine) elevators building by this firm are for the Hoosac Tunnel, Dock and Elevator Co., not N. Y. & N. E. R. R. Co., as stated in a late issue.

The Ashcroft Manufacturing Co., Boston, Mass., have just made for the Pullman Car Co., Pullman, Ill., a large set of 14″ instruments, consisting of steam, vacuum and back pressure gauges, a clock with best Howard 8-day movement, and a revolution counter registering 9999999. They were made with deep case, full nickel plated, engraved and mounted. The set will be used in the engine room of the Corliss Centennial engine. They have made nearly a duplicate of the above set for Border City Mills, Fall River, Mass., the exception being that the Howard clock had a regulating device indicating revolutions of engine on its dial. They have also made two sets for Western water works.

Machinists' and Engineers' Supplies.

NEW YORK, July 28, 1881.

The renewed activity in the iron market has been reflected in the supply market. Prices are stiffening, goods are more scarce and every one is looking forward to a good fall trade.

Iron pipe has advanced and is now quoted at 65 per cent. discount from list with an active demand for all sizes.

Dean Bros. Steam Pump Works, Indianapolis, Ind., has issued a neat new illustrated catalogue of their steam pumping machinery. The Babcock & Wilcox Co., 30 Cortlandt street, New York, have issued the seventh edition of their illustrated pamphlet, entitled "Useful information Pertaining to the Generation and Use of Steam," with catalogue of their manufacture. The Golden State and Miners' Iron Works of San Francisco, have issued a new 108 page circular of steam engines, boilers and machinery.

Iron and Metal Review.

There is a more hopeful feeling than last week in the pig iron trade. The quantity sold has been large. Prices are a shade higher. We quote: No. 1 X Foundry, $24; No. 2 X Foundry, $22, and Grey Forge, $20. Scotch pig is not active. Eglinton. sells at $21; Coltness at $23.50 to $24, and Gartscherrie at $23 to $23.50. The rail market continues brisk. Iron rails sell at $48 to $50, and steel rails $58 to $60 at mill. No. 1 wrought scrap is held at $30 from yard. Ingot Copper is selling in small lots at 16½c.; pig tin is strong at 20½c. for Straits, 20⅝c. for Australian, and 20¼c. for Billiton. Common Lead is steady at 4¾c. to 5c., and refined at 5⅛c., to 5¼c. Western Spelter is firm at 5c. to 5⅛c.: no Silesian offered. Sheet Zinc, 7c. Antimony, 14½c.

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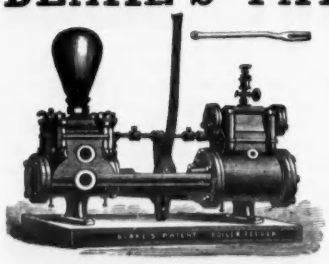

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Gentlemen:—We have used your Files, more or less, for several years, and we take pleasure in saying that both the new and re-cut Files have given entire satisfaction. Yours truly,
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We print on card board 10 x 12 in. "Instructions on the use of Files," which are intended for shop use. These instructions with our "Illustrated Catalogue of Files" we mail on receipt of 27 cents postage. To customers we mail a complete set free of charge.
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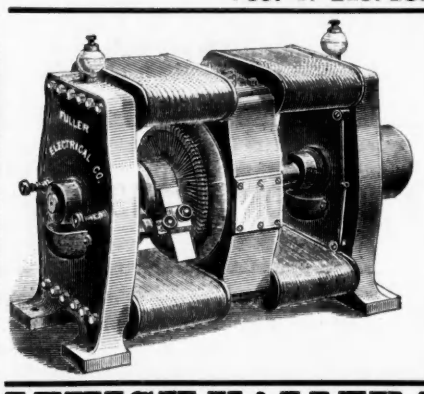

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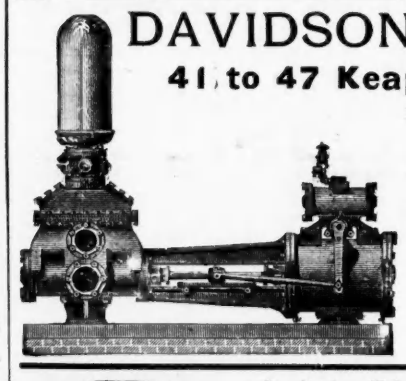

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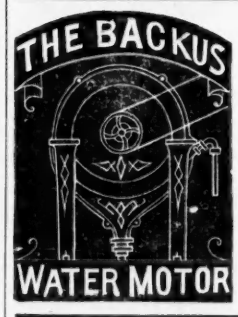

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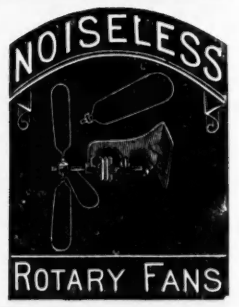

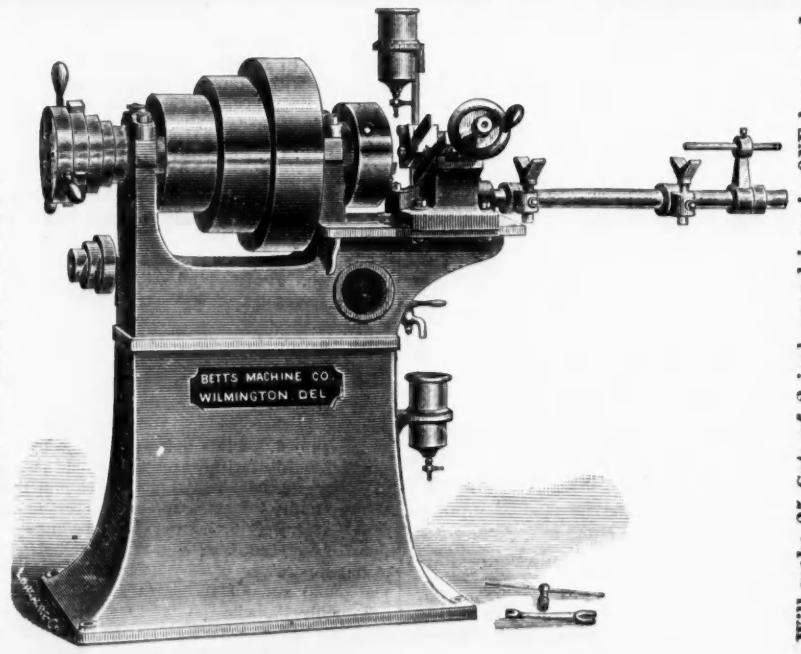

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